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Problems of Our Time*

ROBERT S. PLATT

During attendance at meetings of the Association of American Geographers in the past twenty-odd years, I have spoken many times about seemingly insignificant things. Therefore to avoid disappointing anyone on this occasion I must begin with something small, an item of microgeography. The object chosen for attention is a small piece of land, one square mile, in northern Illinois.

Previous samples of microgeography have led to an assumption that a picture show rather than a straight scholarly paper is to be expected from me. Therefore, to avoid another possible cause of disappointment I am including pictures and maps too.

But in this connection I have an apology to make. On account of trouble with my postwar reconversion there has been a delay in returning to my camera. Consequently other people's pictures have been included in this presentation. This fact is not easily reconciled with my conviction that pictures as well as maps are expressions of ideas, no less than written words of text are such, and that therefore the use of other people's maps and pictures is almost like composing a paper of quotations from other people. But at least I have had a hand in the maps, and have taken some of the pictures; and writing with quotations is all right anyway.

In spite of such concessions as the inclusion of microgeography and illustrations, I am fully aware that if this is to be a bona fide presidential address it must be on the subject: "What Is Geography?" Therefore I must admit explicitly a fact which has always been implicit in microgeography: that the little spot of which I speak is included only because of its larger significance

* Presidential address, delivered before the Association at Knoxville, Tennessee, December, 1945.

in relation to the world and as it contains the world—not merely as a simile but as an epitome of the world and as a nerve cell in world order, like "the flower in the crannied wall"[1] which holds the secret of life and is affiliated with the universe.

Problems of our time involve the interlocking of human life over the whole earth, and simultaneously the localization and even to some degree the isolation of life in every individual place on the earth. In one square mile there is evidence of these antithetical aspects of life—world unity and disunity, coherence and incoherence, attachment and detachment, conjunction and separation, interdependence and independence—opposite but coincidental aspects of life to be met and dealt with willy nilly by everyone who lives on the earth, and subject to understanding by geographers if understandable by anyone at all.

SECTION 16

Now look at the square mile in northern Illinois: Section 16 in Township 38 North, Range 13 East of the 3rd Principal Meridian (Fig. 1). The checkerboard system of land subdivision in which this call number occurs was invented and adopted as the official system for carving up the lands of the Northwest Territory soon after the American Revolution.[2] Northern Illinois was surveyed and the designation 16–38–13 was applied to a particular tract of land, on the ground, early in the Nineteenth Century.[3]

At that time Section 16 was of no particular interest or value either to the Indians who inhabited the region or to the whites at Fort Dearborn ten miles away at the mouth of the Chicago River. It lay within a strip of territory ceded to the United States by the Sac and Fox Indians, in the vicinity of the portage route between the Chicago and Des Plaines Rivers,[4] but it was not on the portage or on any other line of travel. The section was an almost featureless bit of the Chicago lake plain, treeless and poorly drained—featureless except for a low beach ridge, an undulation so slight as hardly to deserve notice (Fig. 2).

Since that time Section 16 has become useful and valuable. Its present use is in contrast with that of surrounding sections in the lacustrine plain, apparently not because of any difference in the natural landscape but because

[1] Tennyson, A.: "Flower in the Crannied Wall," in Tennyson's Poetical Works, Boston, 1898, p. 274.

[2] Ordnance of 1785. Ford, A. C.: "Colonial Precedents of Our National Land System" in Bull. Univ. Wis. #352, Madison, 1910, pp. 57–60.

[3] Bretz, J. H.: "Geology of the Chicago Region," Bull. 65, Ill. State Geol. Surv., Urbana, 1939, pp. 17, 18.

[4] *Ibid.*, p. 17.

of the number 16. The ordnances organizing the Northwest Territory contained a provision that all sections numbered 16 were to be dedicated to the support of education.[5]

This provision did not of course result in similar use of every Section 16. For example, in the next township northeast of the one of which I am speaking Section 16 extends into the heart of the Chicago Loop and its present use is indistinguishable from that of adjacent sections. In this case Section 16 discharged its obligation to education through subdivision and sale of the land more than a century ago.[6]

But our Section 16, on the outskirts of the city, has been held intact as the property of the Chicago Board of Education. Thus in striking contrast with the surrounding sections of other numbers, all of which have been subdivided and partly utilized for private homes or business, Section 16 has remained until recently largely unoccupied and available for the Chicago Municipal Airport, the most insistent new customer for such an unbroken tract of land (Fig. 3). The Board of Education has leased 618 acres to the city for the airport, and has retained a few acres, near the southwestern corner of the section, for a public school built just before the airport. In addition to these two establishments, the airport and the school, the only other occupant of Section 16 is a business building on leased land at the southwestern corner containing a bar and liquor store, a Chinese laundry, a hobby shop, and an apartment (Fig. 3).

All of these establishments have come under observation from a geographic viewpoint. Two have been chosen for discussion, the airport and the school, in their local, regional, and world relations.

CHICAGO MUNICIPAL AIRPORT

The airport has a suitable environmental setting. It is on a smooth plain, as it should be. Also it has runways for taking off in eight directions of the compass, which is in accordance with the fact that winds to be taken into account blow from all these directions at some time or other (Fig. 4).

A preference for environmental causation in explaining the pattern may lead to a conclusion that the predominance of southwest and northeast winds has determined the construction of three runways oriented southwest-northeast, as compared with only two runways in any other direction. But a healthy impartiality toward environmental and non-environmental interpretation leads to a different conclusion. When the airport was enlarged from

[5] Ordnances of 1785 and 1787. Knight, G. W.: History and Management of Land Grants for Education in the Northwest Territory," in Papers American Historical Assn., vol. I, #3 (1885), pp. 13, 17–19, 36, 77–81. Schafer, J.: "Origin of the System of Land Grants for Education" in Bull. Univ. Wis. #63, Madison, 1902, pp. 39–41.

[6] Pierce, B. L.: *History of Chicago,* N. Y., 1937, Vol. I, p. 57.

its original half-mile square in the southeast quarter of Section 16, the southwest-northeast runway was the only one which could not be lengthened and therefore had to be left as it was, while two new long runways were built, making a total of three of the same orientation, one of them a short vestigial remnant of little utility (Fig. 5).

Such historical accidents do not always coincide with the best so-called "adjustments to the natural environment." For example, the longest runway is the southeast-northwest, although the wind rose shows less need of that orientation than of any other (Fig. 4). It happens that this is the longest because the only similar long diagonal, in the most important direction, is slightly shortened by the location of the school yard in the southwest corner (Fig. 4).

The pattern of runways is bordered by a string of closely associated functional establishments (Fig. 5): a passenger terminal, mail and express terminals, offices and hangars of nine air lines, the national headquarters and shops of one line, a traffic control tower, a Civil Aeronautics Administration control center, a Weather Bureau forecast center, immigration and customs offices, an Army transient aircraft hangar, a National Guard hangar, air taxi offices, supply company stores; and various secondary establishments within these: wire and radio communications, lighting systems, cafes and newsstands, ticket and information offices.

These all operate in mutual accord in the coming and going of aircraft. Some of them fulfill the immediate local needs of people—the lunch rooms and ticket offices in the passenger terminal, for example (Fig. 6); others the needs of cargo—the loading and unloading devices, for example; others the immediate needs of aircraft, such as the repair shops, and refueling equipment (Fig. 7); others the local arrangements of the landing field—the Weather Bureau, the field lighting system and visual signals, the runways themselves.

Some of the constituent establishments reach out farther to operate as the focal center of a larger area: the traffic control tower reaches out by radio supplemented by direct contact to a distance of about ten miles (Fig. 8); the Civil Aeronautics Administration control center reaches out by radio to a distance of about two hundred miles along nine air routes in northern Illinois and adjacent parts of Indiana, Michigan, Wisconsin, and Iowa (Fig. 9); the Weather Bureau forecasts for an area about four hundred miles in radius (Fig. 10); the headquarters of the various airlines have jurisdiction over part of a system for certain functions and over a whole system from coast to coast in the case of United Airlines with head offices in Chicago (Fig. 11). The Army headquarters for transient aircraft has jurisdiction over an area in the North Central states (Fig. 12).

The common objective of the whole group of establishments is the orderly arrival and departure of air traffic to and from and through Chicago. The traffic moves in and out along air routes ramifying from Chicago east, west, north, and south over the United States. Starting from Chicago airliners fly eastward over the square-mile sections of the Northwest Territory (Fig. 13) to the metes-and-bounds pattern of the older Appalachian and Atlantic Seaboard states (Figs. 14 and 15); or from the square sections of Illinois southward over the metes-and-bounds of Kentucky (Fig. 16) or of the Delta in Mississippi (Fig. 17) to the Gulf Coast; or from Chicago westward across the Mississippi (Fig. 18) to where the squared pattern fades at the foot of the Rockies (Fig. 19), and on beyond to the Pacific Coast.

AMERICAN AIR TRAFFIC

From a Chicago point of view the airways of the nation have their center here (Fig. 20). From another viewpoint based on the traffic pattern of the United States (Fig. 21), Chicago is seen to be one of the three major traffic centers of the country, in a class with NewYork and Washington. Chicago is the inland focus of heavy traffic, from which a crowd of lines extends eastward to the Atlantic Seaboard and divergent lines spread westward. Chicago is reached by nine airline companies, more than any other center, though it does not have a prominent place on every one of these lines.

Chicago is the main center for United Air Lines (Fig. 11); a secondary center and northwestern terminal for American Airlines, with headquarters in New York (Fig. 22); a secondary center for Transcontinental and Western Air, with headquarters in Kansas City (Fig. 23); a primary eastern terminal for Northwest Airlines, with headquarters in Minneapolis (Fig. 24); a western terminal for Pennsylvania Central Airlines, with headquarters in Washington (Fig. 25); a secondary northern terminal for Eastern Airlines, with headquarters in New York (Fig. 26); a northern terminal for Chicago and Southern Air Lines, with headquarters in Memphis (Fig. 27); a northern terminal for Braniff Airways, with headquarters in Dallas (Fig. 28); and a new northern terminal for Delta Air Lines, with headquarters in Atlanta (Fig. 29).

Evidently Chicago is important but not preeminent with respect to airline connections. Of the airline traffic of the country 75 per cent is handled by these nine lines, and a third of this goes via Chicago, 25 per cent of the air traffic in the United States.

All the airline companies would be glad to serve all the large traffic centers, and although they are restrained by the Civil Aeronautics Board from flying wherever they please, there is nevertheless a tendency to allow all the major lines to reach the major centers, and to compete over the routes

of heavy traffic. In general it is apparent that the pattern of air traffic corresponds with that of surface traffic: air traffic is heavy and closely spaced where surface traffic is heavy and closely spaced—particularly where first-class passenger and express traffic on the surface is heavy and dense.

WORLD AIR TRAFFIC

As the air traffic of Chicago is only part of a larger national pattern of traffic, so the national pattern is only part of a world pattern. The air traffic of the world just before the war is shown in Figure 30 on an equidistant projection with Chicago as a center. Obviously this does not make Chicago the air transport center of the world. In the total pattern the area of heavy traffic in the United States appears as one of the two great regions of heavy traffic in the world. Eastern United States and Western Europe stand out as twin nuclei of air traffic, on opposite sides of the North Atlantic (Fig. 31).

These two nuclei are fairly similar in form, size, and density. In spite of the fact that in one case the transport organization is based on private companies operating on overlapping airline systems and that in the other case organization is based on governmental monopolies operating from separate political centers, no great contrast appears in the resulting patterns. Chicago, New York, and Washington have counterparts in Berlin, London, and Paris as major focal points; intervening and outlying lines and secondary points also are comparable.

From the two nuclei of the North Atlantic, airlines extend to outlying regions of the world. In this extension of lines the two great focal areas have shared with a fair degree of equality, and without a division into hemispheres or continental spheres of influence. The great powers participate as world powers, not hemispherical powers. The name "Pan American Airways" indicates a first objective of American foreign effort, to link the United States with Latin America, but the name did not prevent a quick and natural transition to the rest of the world, reflecting both the lack of hemispherical division for air transport and the positive place of the United States as a world center rather than merely a Western Hemisphere center (Fig. 32). So lines from the United States have extended not only to South America, but also across the Atlantic to Europe and Africa and across the Pacific to Asia and Australasia. Simultaneously lines from Europe have reached to the same outlying continents—South America, Africa, Asia, and Australasia—from different directions (Figs. 33 and 34).

There have been differences in detail among the North Atlantic powers but general similarities in objectives, as further indicated in cases in which plans have not been fully carried out. For example, British plans to reach

South America did not materialize before the war, but are proceeding now. German and Italian lines, not shown on the accompanying maps, did reach South America.

In general, lines from both of the North Atlantic nuclei have extended to all of the outlying continental areas. In general also the airlines have followed the main routes of surface traffic in the world, just as airline traffic in the United States and Europe has corresponded with surface traffic. So overseas airlines have paralleled the great sea routes and penetrated inland along railway and river routes, taking short cuts across land masses and making detours to refueling stations but really heading for the same ports and inland centers as those reached by modern surface transportation.

The war broke the world pattern of air transport, as well as that of surface transport, into three pieces: the two Axis spots and the United Nations over the rest of the world (Fig. 35). Apart from the sharp break, a noticeable characteristic is the relatively slight amount of change in most parts of the pattern, in spite of the fact that Germany controlled all but a particle of the European nucleus and that accordingly worldwide air transport sprang mostly from the American center instead of from both sides of the North Atlantic.

Of course the redistributions of war produced many specific changes within the general pattern (Fig. 36). One of these was a conspicuous concentration across the Hump from India to China—an abnormality in world air transport, where the airline did not parallel modern surface transportation but extended beyond the end of an ocean shipping route into an area not accessible by modern surface transportation. The fact that there are not many similar places in the air traffic pattern, either in war or in peace, suggests that areas with much freight to be handled are generally provided with cheap modern surface transportation and need depend only temporarily in special cases on the air to carry ordinary freight cargoes as well as first-class passengers and express. Freight traffic across the Hump has ceased with the end of the war.

The map (Fig. 36) does not indicate Army traffic within the United States and so fails to show Chicago as one of the centers, having seventeen regular flights a day and many irregular flights.

Now the postwar pattern has begun to form. Prewar ways are being resumed, with the retention of some wartime modifications and the abandonment of others. The United Nations have reached into the Axis spots. The European nucleus again has become a center of overseas lines to match those of the United States. Some overseas routes of the American Air Transport Command have been given to American domestic airlines. Once a week an

airliner leaves Chicago for a roundtrip flight to London via Newfoundland and Eire (Fig. 37).

WORLD UNITY

The increasingly irresistable unity of the world is disclosed in the pattern of airways— a pattern in which every part bears a clear relation to every other part. Aviation over the world is all cut from one piece of cloth; it is of one cultural variety. Even more than is usual in elements belonging to one type of culture the features of aviation are nearly identical over the world, the parts interchangeable: the fields, the planes, the pilots, the routine of operations, the ritual of service, the etiquette of crew and passenger behavior.

Other big city airports resemble that of Chicago, each with a criss-cross pattern of concrete runways according to the present style, and each conforming in specific details to local limitations of site (Figs. 38 and 39). Even little airports in out-of-the-way corners of the world belong to the same species and resemble the Chicago airport of less than twenty years ago (Fig. 40).

Why should not aviation be alike all over the world? There are no culture regions more closely bound together than the pattern of airways by actual passage of people and things and ideas, freely back and forth, in periods of time shorter than a phase of human life, or a change of season, or even than a passing mood or a current disposition.

Well might Bob Hope write the story of his world travels under the title: "I Never Left Home."[7] Across the world he stayed within the narrow limits of a segment of his own people and recognized the fact. Wendel Willkie looked a little farther beyond the wings of his plane and noticed the same unity in a world-wide pattern.[8] Probably for geographers the greatest surprise in this was that people in general were surprised by the discovery that we are all on one world.

So Section 16–38–13 has its place in a world pattern; its facilities are duplicated throughout the pattern; its constant contacts are with other areas of the pattern; its activities are integral parts of the functional life of the whole.

Our system of airlines is not necessarily permanent. The airway pattern is a fragile feature of the current unstable Occidental organization of the world. The wartime fracture into three parts indicates what can happen, not locally and temporarily, but completely and irrevocably, as a result of international discord and disintegration.

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[7] Hope, Bob: *I Never Left Home*, New York, 1944.

[8] Willkie, Wendel: *One World*, New York, 1943.

But even though this particular pattern may disappear, the problem of interrelations on a world scale is with us to stay and probably to increase, under conditions in which one place, like Section 16, has contacts with other places, more and closer contacts with any or all places, for better or worse. The problem is rooted in a permanent circumstance of human life: the unbroken unity of the world habitat.

Geographers, surprised by common failure to recognize world unity, are surprised again by the common failure to recognize disunity. Great and permanent differences from region to region are obvious in the landscape as seen from the air. Localization and separation between places are less obvious but no less persistent than the broader differences.

Unity and disunity seem not to belong together, and when one is discovered the other is too often repudiated. But they do belong together, as permanent characteristics of the world, and both raise problems to be dealt with simultaneously.

NATHAN HALE SCHOOL

In this conection look again at Section 16. It contains also the school (Fig. 41), crowded by the encroachment of the airport, but still holding its place, having a prior claim to the land, standing there before the airport existed and perhaps destined to stand there after the airport has been abandoned for a larger site.

The Nathan Hale School furnishes elementary education to 850 children in a district of two square miles. The design of the school is that of the Chicago Public School System as prescribed by the City Board of Education: the architecture and equipment of the building, the curriculum, textbooks, teacher training, administration. In large part these features are not peculiar to Chicago but are drawn from the larger national field of American education. Most of the teachers have taught in other schools and none of them live in the district. Thus the school like the airport is a single example of a culture-type well known and repeated elsewhere; and its connections with other places, near and far, are numerous and constant.

But the school differs fundamentally from the airport in the range of objectives on which attention is focused. At the airport attention is focused on distant places and successful operation requires far reaching coordination, on a nation-wide or world-wide scale. At the school attention is focused on the immediate vicinity and successful operation requires first-hand response to immediate issues on the spot. The primary objective of the school is the education of children for life in a local community. The teachers, with all their standardization brought from elsewhere, are confronted daily

with the fact that the student body is a distinctive group of individuals in a distinctive community (Figs. 42, 43 and 44).

The home background of the children is fairly homogeneous, economically and socially. They are white Americans and their parents are factory workers like many others in and around Chicago. But this is not the whole story. Some of them are the grandchildren of settlers from the Netherlands who founded a truck farming community in this area, cultivating a few fields temporarily on the site of the airport and still cultivating some fields within a few blocks of the school. A larger number are the children of Polish and German parents who settled here when freight yards and factories were established in this vicinity.

Finally the most conspicuous element is that of children recently brought to the district by parents of old American stock who have migrated here during the wartime expansion of industry, some of them from rural Indiana and a few from Tennessee, but the dominant component from one county[9] in the hills of southern Kentucky. Their Southern Highland dialect and their Hill Billy music are heard in the school. Many of them are related to each other or have known each other as neighbors in Kentucky. Whether both Martins and Coys are included I do not know.[10] There seems to be no feuding here.

A spirit of independence is noticeable both among the children and throughout the district, a spirit to which the Dutch and Polish families as well as the Kentuckians seem to contribute, not as mutually antagonistic groups but as active members of a coherent community.

The school district is in fact a fairly distinct community having a compactly built-up area, bounded by sparsely inhabited rural areas on the west and north, and cut off by the uninhabited and untraversable airport on the east and industrial district on the south (Figs. 3 and 42).[11] The community is not well connected with downtown Chicago, either by street car requiring a two-hour journey, or by airport limousine costing a doller one way.

So there is a local sense of being a little different and quite separate from other neighborhoods. The center is a small business district based on the crossroads at the southwest corner of Section 16, to which belong the bar, Chinese laundry, and hobby shop previously mentioned (Fig. 45). Around the business center is a residential area of small homes (Fig. 46); and beyond this are small farms surviving from the time of rural settlement, still only a few blocks from the school (Fig. 47).

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[9] Adair County.

[10] Berlin, I.: "The Martins and the Coys," New York, 1936.

[11] Clearing District. See Hoyt, H.: *One Hundred Years of Land Values in Chicago,* Chicago, 1933.

There is some pride in the history of settlement and growth, from truck gardens to industrial planning, and interest in the homes and service establishments of the community. Among the several social and civic organizations the Parent Teachers Association is particularly vigorous, having over three hundred families actively participating, showing a sustained interest in the school and exerting a helpful influence.

In the school the characteristics of the district as a distinctive community are recognized by the principal and teachers, and receive consideration beyond the limits of the standardized routine. The school serves as a community center, for weekly dances of young people beyond school age, and occasional gatherings of older people. Even in the course of study a first effort at understanding the local area has been made.

The social-studies room gives evidence of the several areas of attention: the world on a globe and a wall map, the nation in a series of posters depicting "Our America," the city in a display on Chicago history, and the school district in a project to "know our neighborhood." The direction of progress has not been from nearer to farther horizons, but in the reverse direction, from the world as a whole covered with scanty knowledge and small interest to the local area seen with new understanding and vital interest.

The social-studies teacher, who has some background in geography, has conducted field trips to individual factories in the industrial area where the people of the community work (Fig. 48). Special assignments, illustrated reports, and public presentations in the assembly hall have aroused more enthusiasm and cooperative effort, both inside and outside the school, than any other subject of study (Figs. 49 and 50).

However, this is only a beginning, carried on only by individual initiative and exertion, with little encouragement from the Board of Education. Higher authorities in school administration generally are interested in expansive ideas and phrases for standardized, widespread "air age" and "global" education, rather than in small projects of local application. The local program at the Hale School could proceed toward an understanding of other aspects and problems of the district, and other services to the community. But it is not certain that the program will continue; in future the school routine may be controlled more fully from city headquarters, and regimentation may increase.

WORLD DISUNITY

Yet even though this particular program may disappear and though the school district itself may lose its distinctive character and be submerged in the big city, nevertheless the problem is still with us, of dealing with individual human beings, understanding their immediate surroundings, and safe-

guarding the values of local life and cultural variety. Indeed this problem becomes more urgent as the forces of large scale organization and mechanization sweep away local differences and separations, and reduce the responsibility and independence of local groups of people. The problem is rooted in a permanent characteristic of human life, the social and physical localness of human beings in distinct and different localities.

The school and the airport, taken as an epitome of the world, have been discussed at sufficient length without any statement of their relations to each other, except that they are located in the same section of land. The fact is that their mutual relations are largely negative. The public entrance to the airport is more than a mile from the school, and most of the contacts are over the back fence. The school building is a minor hazard to aviation as a high structure on the edge of the field. The airport is a noisy neighbor to the school, particularly when the wind is easterly and planes warm up their motors close to the school, but also when the wind is westerly and planes take off over the school.

The people of the school district do not work at the airport but in the industrial area, where the number of employees is many times greater and the training requirements are different. Children of the school have been more inspired by tangible manufacturing processes observed on trips to the factories than by ideas of the world-wide connections of the adjacent airport. The landing field is a barrier to the transportation and growth of the community. Isolationism on both sides of the fence is quite natural, as the airport looks out over the airways of the world, and the school looks to the children in its little district.

Evidently the airport and the school are not well coordinated, not mutually helpful, and not aware of each other's functions and problems. But they are not necessarily antagonistic: they appear together simultaneously in the same social order to perform equally vital functions by no means unrelated.

WORLD PROBLEMS

The respective problems which they raise are critical in our time, and both demand attention. On the one hand, how shall we arrange our far-reaching activities, our world-wide interdependence, now calling for split-second cooperation and presupposing universal agreement on objectives and means of attaining them? On the other hand, how shall we provide for individual human beings and their local initiative in their immediate surroundings, now threatened with submergence in a world of total organization and centralized control?

As we face these questions there is doubt about our finding answers good enough to provide for survival of our existing world order and our American

way of life, to say nothing of a better world or a better America. Can we count on sufficient agreement as to objectives and means of attaining them either among nations or among ourselves? Do we want freedom of the air or control of the air? Can we have freedom without control? Can we have freedom with control? Do we want to maintain our sovereignty over air bases or give up sovereignty? Is our present national organization good for peace or good only for war? Is the atomic bomb a means of protection or is it like a hand grenade held by a four-year-old child? Can we have security and welfare provided by government planning or evolved through private enterprise? Can we keep our family and community life under industrialization, urbanization, and socialization? Can we keep individual initiative, personal responsibility, and self-respect without local option for better or worse?

Such questions may be faced with optimism or with pessimism. Our old political, economic, and social structure may or may not be flexible enough to withstand and be adapted to new circumstances. Our Occidental civilization may or may not have approached its last years, bogged down in new problems too complex for its old-style equipment (which includes vested interests, pressure groups, and sovereign states). Having approached the Promised Land of a better world, we may be about to enter, or we may be about to retreat into the Wilderness of national and international chaos, to wander there until a new generation, better prepared than we, in some later century, returns to enter.[12]

Even though we choose to be pessimistic about our civilization in this century there is ample basis for a warmer optimism: in the immediate prospect for us as individuals and as geographers, and for this Association and other groups to which we belong. Each of us has a free opportunity to live a great life with the associates and in the environment where we find ourselves, whether in our time we happen to live in a down-swing or an upswing of history.

Why worry about a collapse of civilization? Why be distracted by headline disasters beyond our reach? A time of crisis is no occasion either to stop and stare, or to continue in a petty round of irrelevant details, but is a time for uninhibited action in relevant ways, even though still dealing only with details. In a great fire or flood heroic action is regularly concerned with details close at hand seized with farsighted new purpose in the light of the encompassing event.

So let us fix our attention on what lies before us here and now, whether we are responsible for children at school or planes at the airport, whether we meet with geographers at Knoxville or with foreign ministers at Moscow,

[12] Book of Numbers, Chaps. 13 and 14.

all the while aware of the wide implications of each local act. Thus we all exemplify the opportunities and values in the local lives of individual people, whether the world-wide effects of our work are slight or great.

One step toward solution of national and international problems would be to dispel the false notion that concern with world affairs is *per se* more important than concern with local affairs, attending a meeting on world peace more important than attending one on neighborhood law enforcement, casting one vote in millions for President of the United States more important than one vote in a hundred for a village councilor. Our success in world affairs is likely to depend on our success in local affairs, and also on our handling world affairs like local affairs (since both are handled by human beings), getting them localized and into focus by direct and intimate understanding.

GEOGRAPHERS IN OUR TIME

To meet problems of our time, both local and world-wide, what place is there for us as geographers? So far we have not carried great responsibility. But if we do not carry more, it will be our own fault. From my brief but variegated wartime experience with government, business, and non-geographic university contacts, I am convinced that geographers have a contribution to make and that it is needed and wanted.

In a recent committee of faculty members in social science the trend of discussion has indicated no desire for geography as subject matter or academic formula, but a strong desire for geographers as people with a special approach to apply their thinking apparatus to the problems at hand. In a recent Chicago business contact, an airline has used some geographers, not wanting geography but wanting people who might know how to answer certain questions.

In Washington while doing daily business in the lobbies of the Senate and House of Representatives I have found that much of the time Congressmen need enlightenment in a geographic rather than a systematic form, on China or the Tennessee Valley rather than on general principles of one-party government or of rural poverty. A large proportion of the problems with which people are struggling in local, national, and world affairs are wrapped up in a package addressed to geographers. Generally life comes to people filled with unassorted localized phenomena to be dealt with together, not filled with single categories systematically sorted. Geographers should be able to handle the package comprehensively and analytically, recognizing the ingredients in their relations to each other, including the basic relation of detailed local stuff to world-wide connections and generalizations, and the proper relation of realism to idealism, of things as they are to things as they might be rearranged for better or worse.

A major cause of trouble in our time is that large-scale technical organization has produced new problems so complex and stuck together[13] that they are not solved by specialized analysis or by common knowledge but require more comprehensive wisdom than ordinary people can expect to have. The growth of men has not kept pace with the growth of mechanism, so people have become pygmies among moving masses.

Unfortunately, even geographers are pygmies, unable to control the world disorder and having no trick formula for comprehensive understanding. But at least they are in a position to see the range of problems, to trace world patterns in perspective, and to use whatever intellect and common sense they have in working toward solutions. No other academic group has a more valid or hopeful line of approach. Therefore, let us discard hampering inhibitions and play our part with the best judgment and ability we can muster.

The great success of physical science in organizing the material world has led to expectations of approach from the same direction for control of human society. Popular attention, fixed on systematic science, is quite unconscious of the valuable if not indispensable chorographic alternative. This is an additional reason for geographers to express themselves and act to the full extent of their strength and ability. The geographic contribution will not be asked for by those who do not know that such a contribution exists. Therefore it must be offered without invitation.

This is not intended to suggest strident advertisement of geography as a panacea. Advertisement without demonstration is unconvincing if not irritating, and with demonstration advertisement is unnecessary. Therefore let us demonstrate by applying all the resources of our knowledge to the illumination of the most pertinent problems within our reach. We need scholarly production by all competent geographical scholars, and wise, responsible, imaginative leadership by all competent leaders.

GEOGRAPHERS IN WASHINGTON

In more definite terms, what do geographers want and what can they do? The question may be asked appropriately with respect to Washington, where the greatest concentration of geographers arose during the war and is now subsiding. In the postwar period what do we want in Washington?

In general we may agree on the one hand that we want full and coordinated use by the government of the contribution to public affairs which we can make, including employment of whatever competent geographers are needed in research and policy-making. And we may agree on the other

[13] Grafton, S.: "Our Russian Problem," in *Chicago Sun*, Nov. 4, 1945, p. 18.

hand that we want appropriate governmental aid and participation in the development of the field of geography, to increase geographic knowledge and make it available.

Within these general desires we may be less ready to agree on particular procedures. With respect to making a geographic contribution in public affairs, are we satisfied to have geographers working ahead individually in various agencies and accepting responsibility when it comes to them, or do we want more collective action by geographers, to insist on a voice in domestic and foreign policy-making and to take a united stand on public issues?

With respect to government participation in the development of geography, do we want the Army Map Service to have the one great national map collection covering the world outside the United States for civilian as well as military use; including not only the large-scale series collected during the war but also the much greater number of small- and large-scale maps of all kinds, historical as well as current; distributing duplicates to cooperating universities; providing photostat service for research scholars officially approved; and employing trained geographers in medium grades and below?

In addition, do we want the State Department to develop a peacetime regional intelligence service covering the world outside the United States; producing comprehensive data and maps for the official use of the armed services and the State Department, employing some trained geographers among other specialists for field work and library research?

In addition or instead, do we want the Library of Congress to establish a national center of geographical knowledge, for the use of Congress, government agencies, and the general public; completing the present map collection by the addition of all available maps, covering the world including the United States, cataloging the combined collection, and adding a union catalog of other Washington map collections; developing a regional research catalog based on geographical materials in the Library, and establishing a regional intelligence service, covering the United States and the rest of the world, based on library research and field work, staffed by trained geographers?

These questions call for answers based not on abstract theory but on such practical considerations as whether the project in each case will be carried on with imagination and thoroughness by those in charge, whether policies are to be made and executed by geographers or by higher authorities uninformed and uninterested in geography, whether Congress will provide funds for more than a fiasco.

The questions call for consideration not only of possible choices among the projects, but also of possible coordination and division of responsibilities with a minimum of duplication among the projects. There is also the possible alternative of rejecting all these projects in favor of a Geographical

Survey, more nearly autonomous, like the Geological Survey, administered by geographers, and designed to perform the geographical functions now carried on or planned in various scattered agencies.

At present, activities in Washington are fluid. The projects indicated and others are now pending. All of these or none of them may be realized as planned. The work in which we believe can go forward only through active interest effectively mobilized and strong leadership by geographers.

ASSOCIATION OF AMERICAN GEOGRAPHERS

What do we want this Association to do? In general we may agree that we want the Association to serve geographers, to advance geographical knowledge, and to encourage geographical scholarship and leadership. The Association has played a part, though not a large part, in wartime developments. We know of several things which we would like to have done but which the Association has not done, for reasons good or bad. Probably we can agree that the Association should serve the whole geographic profession either directly, or else indirectly, through support of the American Society of Professional Geographers, the National Council of Geography Teachers, or other agencies, in acting as a clearing house for geographic employment and for research projects, in setting standards of geographical education, and for other purposes.

To deal with these and other problems which confront us, several committees have been at work during the year. One, on Constitution and Policy, has reconsidered the scope of Association activities toward the ends stated above, and the adequacy of the old constitution in providing a framework for new plans and purposes. A second committee, on Geography in the Washington Area, should help us answer some of the questions on Washington projects. A third committee, on Public Relations, has before it the problem of public misconceptions of geography and what should be done about them. A fourth committee, on Field Work, is planning for a phase of geographic study which has advanced during the war for geographers overseas but has stood still for those at home. A fifth committee, on Maps, has been proposed, to lay plans in a field revolutionized during the war.

The Association has been moving forward at a speed commensurate with its traditions and past history. But this is not enough: the Association is failing if it is only keeping up with the past. New acceleration is required for the present and the future.

New officers are about to take office. They are well qualified to take up the torch as it falls from the feeble hands of the old incumbents now passing from the scene. These young men have the ability to give us a change of

pace in keeping with the times and according to whatever mandate we together now proceed to lay upon them.

Let us work out our problems here together as fully and imaginatively as possible, and then go home, each to his own Section 16 or whatever the number is, and go to work, not in the old rut of ordinary times, but in new efforts for new times, pessimistic perhaps on the current trend of our civilization, but immediately and ultimately optimistic as we consider the opportunities now before us, the underlying pattern of the world which we are given to interpret, and the spirit of life which we share.

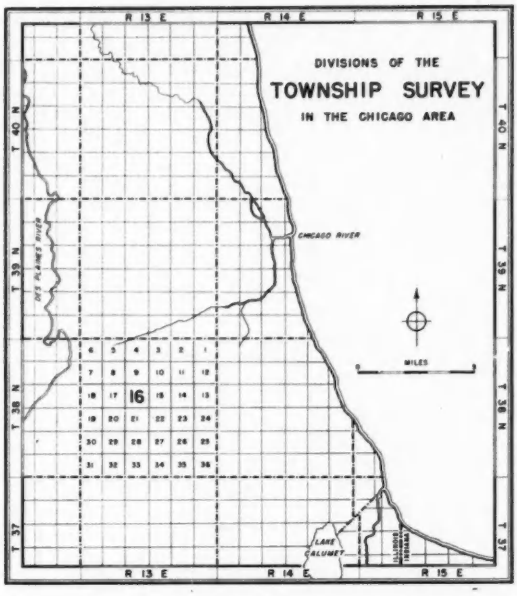

FIG. 1.—Location of Section 16, Township 38 North, Range 13 East, west of the southern end of Lake Michigan. This and following maps drawn by James Wray, University of Chicago. (Drawn from Chicago Dept. of Public Works: "Map of Chicago," 1935.)

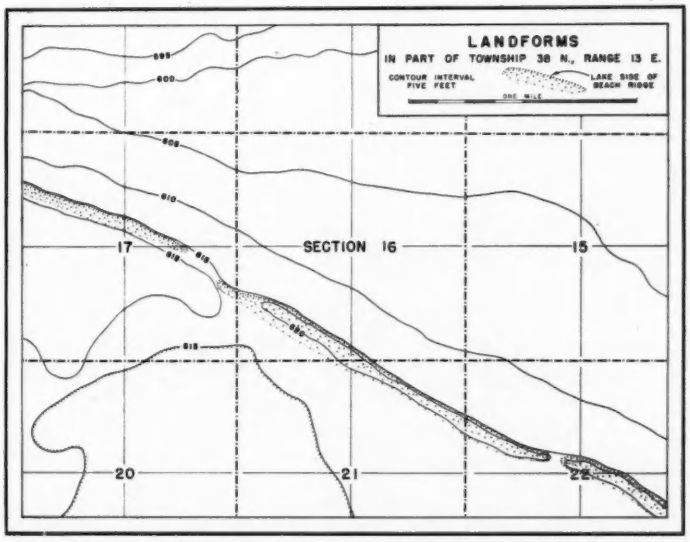

FIG. 2.—Section 16, in the lacustrine plain of Chicago. (Drawn from Bretz, J. H.: "Surficial Geology of the Berwyn and Englewood Quadrangles," Ill. State Geol. Survey, 1932.)

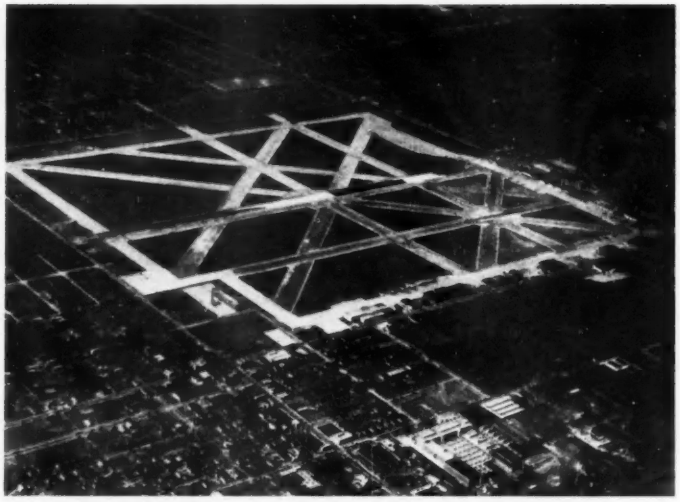

FIG. 3.—Air view of Section 16 from the southwest. Chicago Municipal Airport occupying most of the square mile; airport buildings along south side, south half of east side, and middle part of west side; site for new terminal building along north half of east side. Hale School in southwestern tract of land. Business center and residential area in adjacent sections focussing at southwestern corner of Section 16, with one business building in Section 16. Factories and spur tracks of Clearing Industrial District in lower right corner of picture. (*Acme Photo.*)

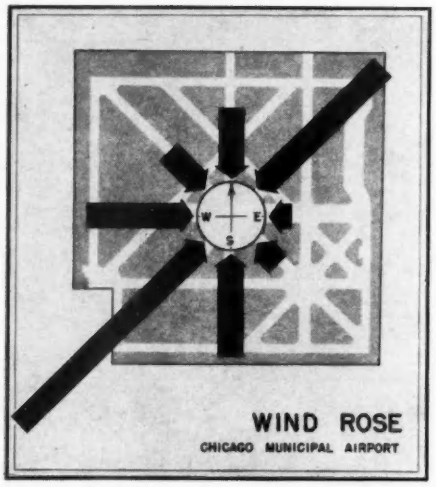

FIG. 4.—Prevalence of winds at the Chicago Municipal Airport. (Data from Cox, H. J. and Armington, J. H.: *Weather and Climate of Chicago*, Chicago, 1914, p. 281.)

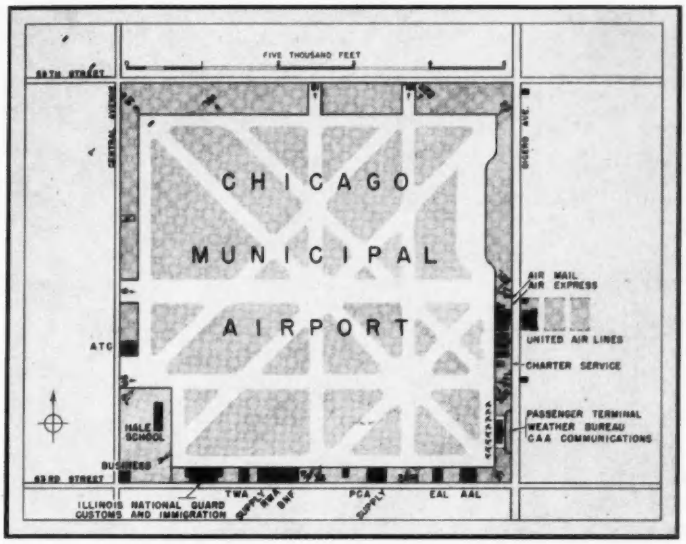

FIG. 5.—Section 16. Runways and buildings of the Chicago Municipal Airport. In addition to the airline companies indicated, there is hangar space for Chicago and Southern and very recently also for Delta; in the near future a foreign line, Trans-Canada, is to be included.

FIG. 6.—Chicago passenger terminal. In the background United Air Lines hangars, and office building across the street. Air view from the south. (*United Air Lines.*)

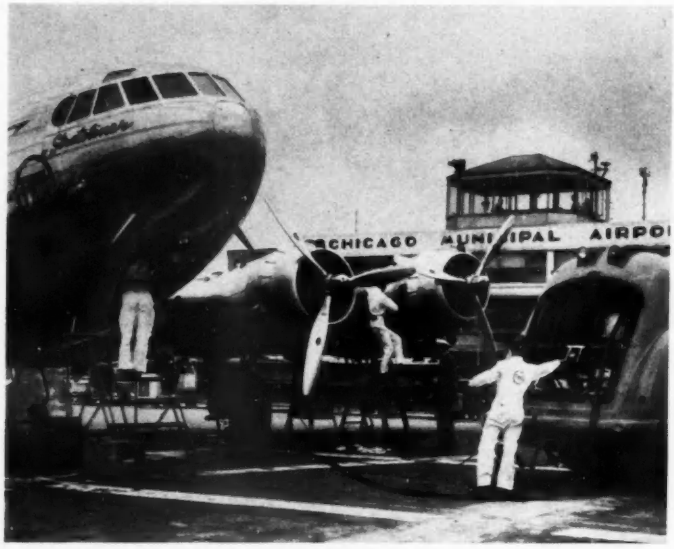

FIG. 7.—Chicago passenger terminal and control tower. Plane loading and refueling. (*TWA.*)

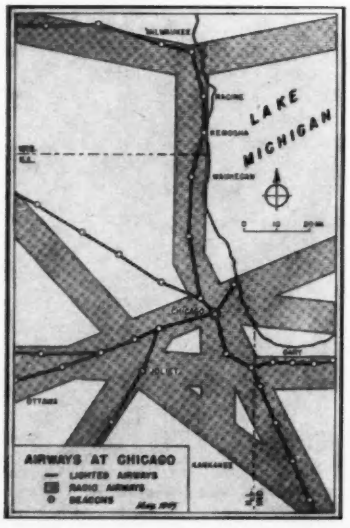

FIG. 8.—Airways near Chicago. (Drawn from U. S. Coast and Geodetic Survey: Regional Aeronautical Chart 9M, 1943.)

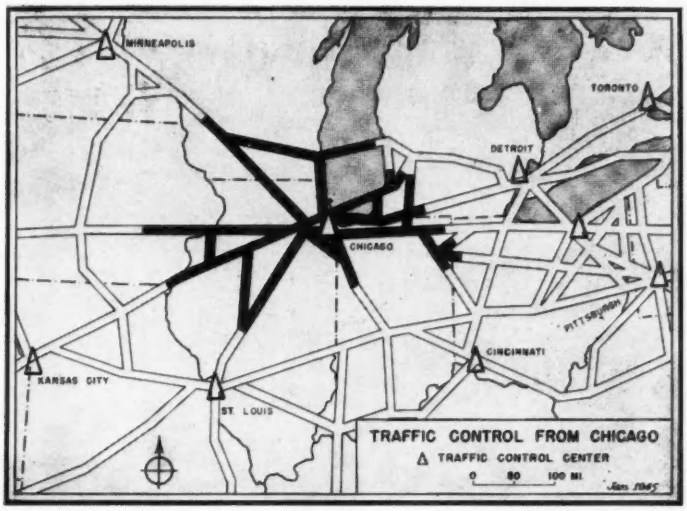

FIG. 9.—Extent of traffic control from Chicago center of Civil Aeronautics Administration. (Drawn from Civil Aeronautics Administration: "Air Navigation Radio Aids," 1945.)

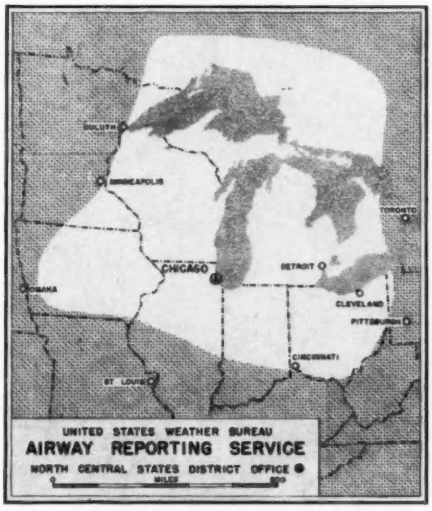

FIG. 10.—Area of airway forecasting from Chicago office of the Weather Bureau.

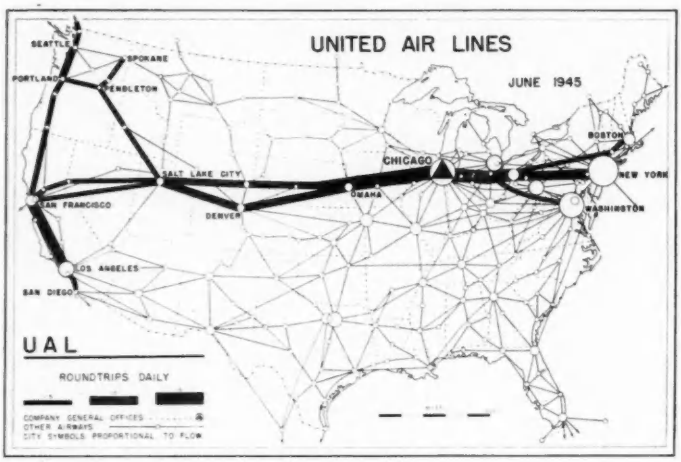

FIG. 11.—United Air Lines routes and traffic. (Data from Official Guide of the Airways, Vol. 17, No. 3 [June, 1945], and American Aviation Traffic Guide, Vol. 1, No. 9 [June, 1945]).

FIG. 12.—Army transient aircraft hangar from the street west of the field.

FIG. 13.—Air view of square-mile sections in farmland on the Lake Erie plain, Paulding County, northwestern Ohio. Parts of eastern and southern Ohio do not have the rectangular township pattern. (Field Service Branch, P.M.A.—*U. S. Dept. of Agriculture.*)

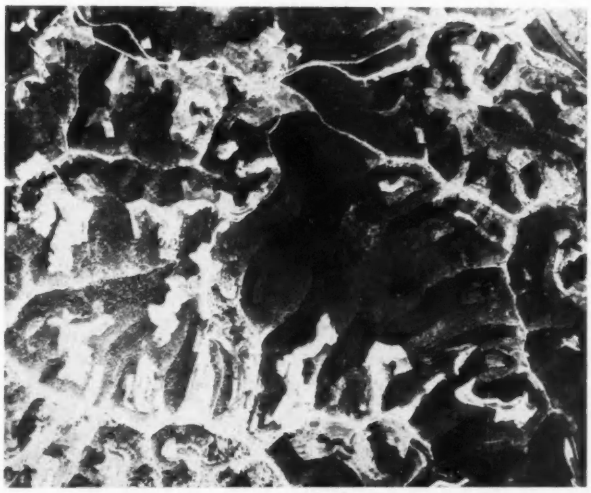

FIG. 14.—Air view of land pattern in the dissected plateau, Calhoun County, West Virginia. Little Kanawha River in upper right corner. (Field Service Branch, P.M.A. —*U. S. Dept. of Agriculture.*)

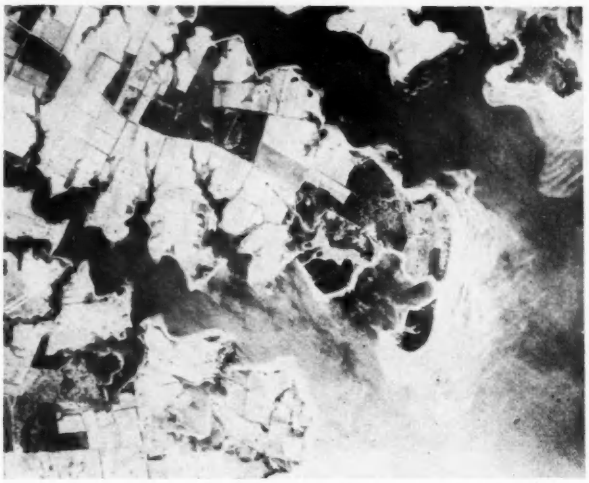

FIG. 15.—Air view of land pattern in Tidewater Virginia, Lancaster and Northumberland Counties, Chesapeake Bay, just south of the mouth of the Potomac River. (*Soil Conservation Service, U. S. Dept. of Agriculture,* 1937.)

FIG. 16.—Air view of metes-and-bounds pattern in southeastern Kentucky, Wayne County. (Field Service Branch, P.M.A.—*U. S. Dept. of Agriculture.*)

FIG. 17.—Air view of land pattern in Yazoo Delta, Tallahatchie County, Mississippi. (Field Service Branch, P.M.A.—*U. S. Dept. of Agriculture.*)

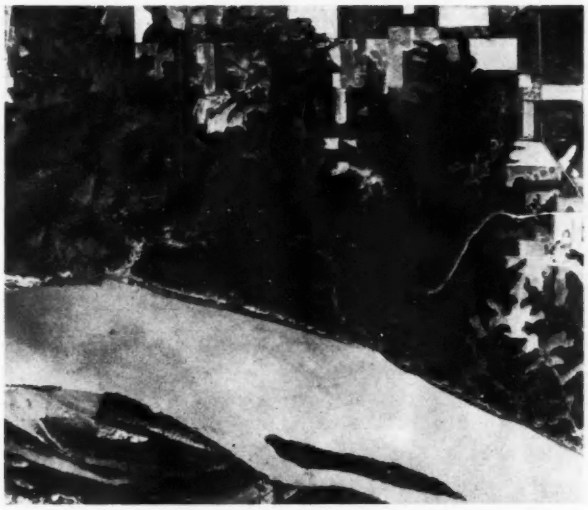

FIG. 18.—Air view of square-section pattern interrupted by dissected border of Mississippi Valley, Jersey County, Illinois. (Field Service Branch, P.M.A.—*U. S. Dept. of Agriculture.*)

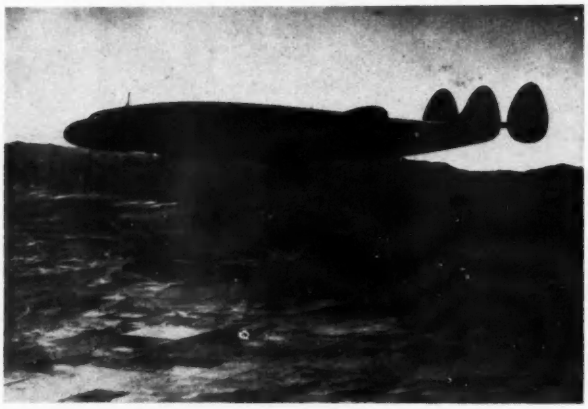

FIG. 19.—Air view of Rocky Mountain front, square-section pattern in foreground, New Mexico. (*TWA.*)

FIG. 20.—Loading ramp from Chicago terminal building. (*United Air Lines.*)

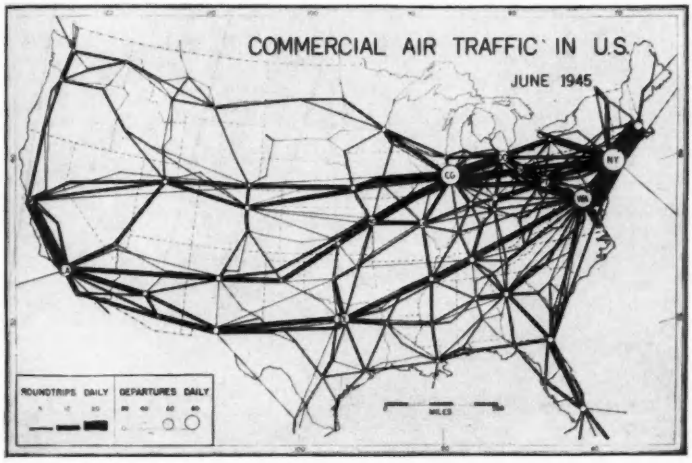

FIG. 21.—Traffic of domestic airlines in the United States. (Data for Figs. 21–29 from Official Guide of the Airways, vol. 17, no. 3 [June, 1945], and American Aviation Traffic Guide, vol. 1, no. 9 [June, 1945].)

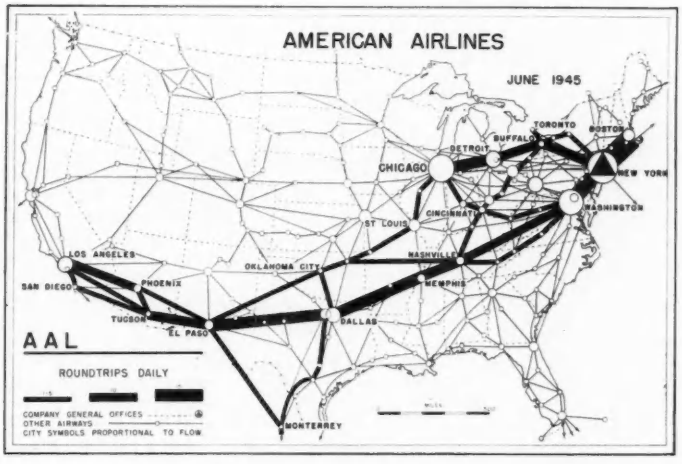

FIG. 22.—American Airlines routes and traffic.

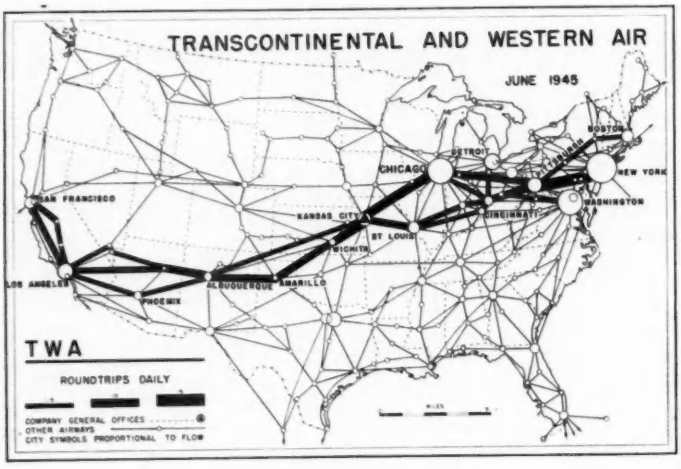

FIG. 23.—TWA routes and traffic.

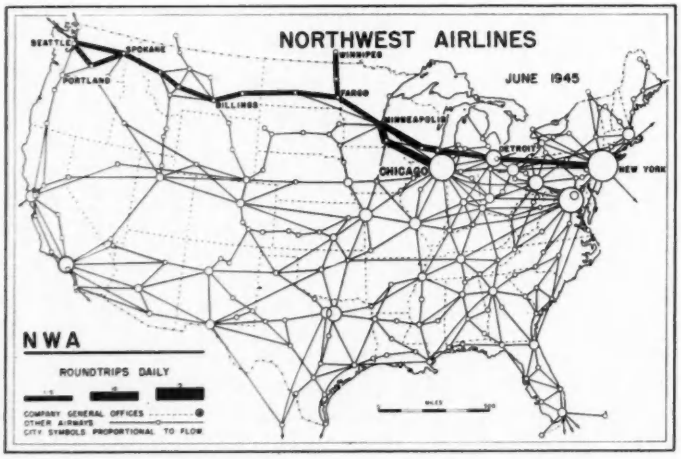

FIG. 24.—Northwest Airlines routes and traffic.

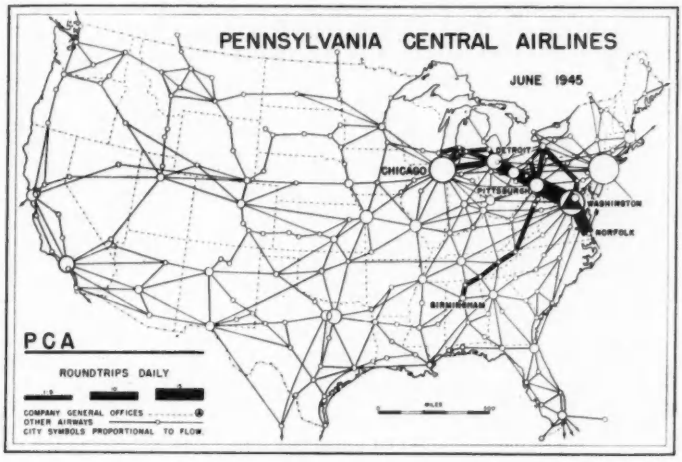

FIG. 25.—Pennsylvania Central Airlines routes and traffic.

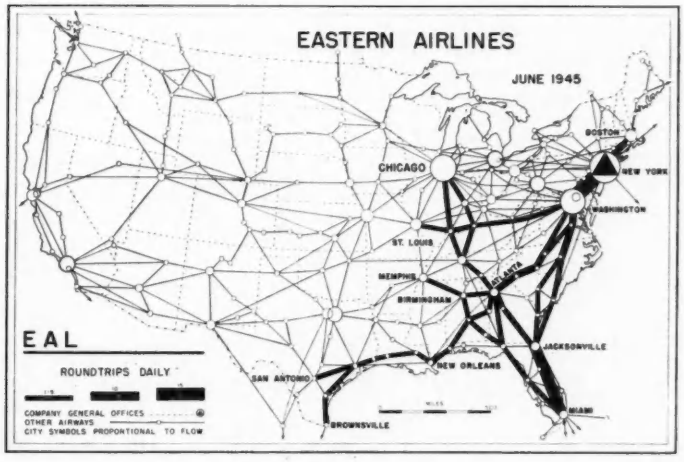

FIG. 26.—Eastern Airlines routes and traffic.

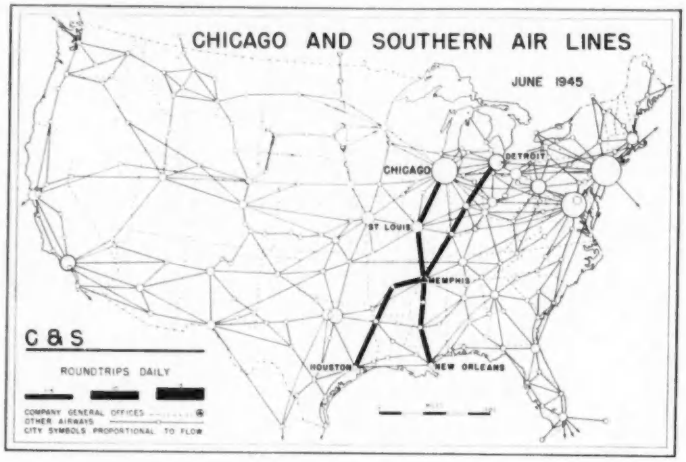

FIG. 27.—Chicago & Southern Air Lines routes and traffic.

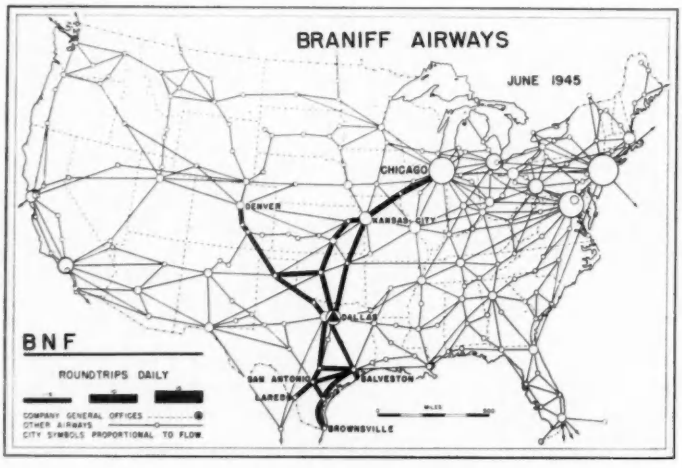

FIG. 28.—Braniff Airways routes and traffic.

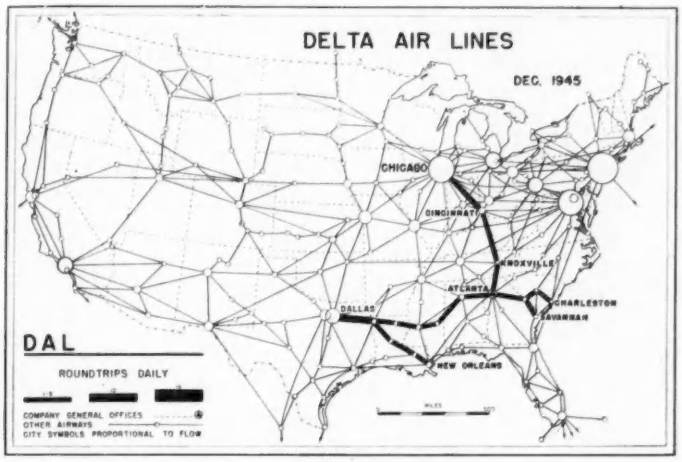

FIG. 29.—Delta Air Lines routes and traffic.

FIG. 30.—World air traffic before the war, on a projection equidistant from Chicago and for most of the world equidistant from Paris. (Data from Official Guide of the Airways, Bradshaw's International Airways Guide, Reichs Luftkersbuch, Gordon's Australian Air Guide; Smith, S. B.: *Air Transport in the Pacific Area*, New York, 1942; Mance, H. O.: *International Air Transport*, New York, 1944.)

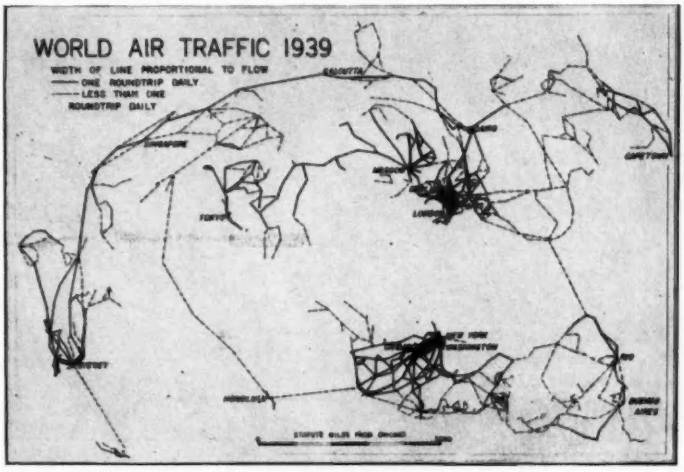

FIG. 31.—Air traffic only, land areas omitted.

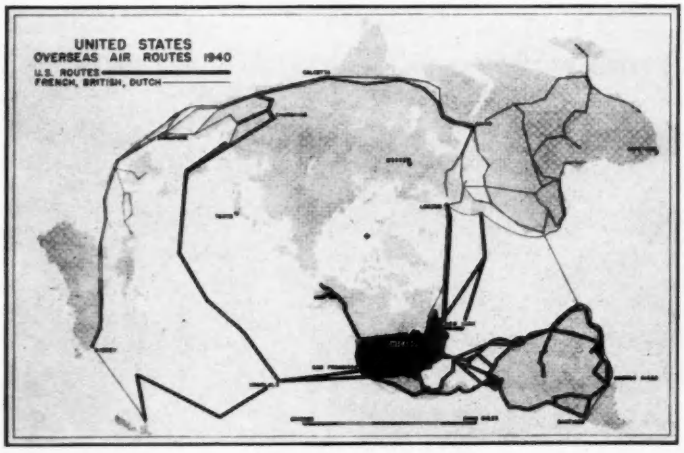

FIG. 32.—Routes of Pan American Airways. United States shown in black without indication of domestic routes. No American route to Africa is shown, but Pan American touched Africa soon after the date of this map, and later penetrated. (Data from *Fortune*, Vol. 23, No. 3 [March, 1941], pp. 126, 127.)

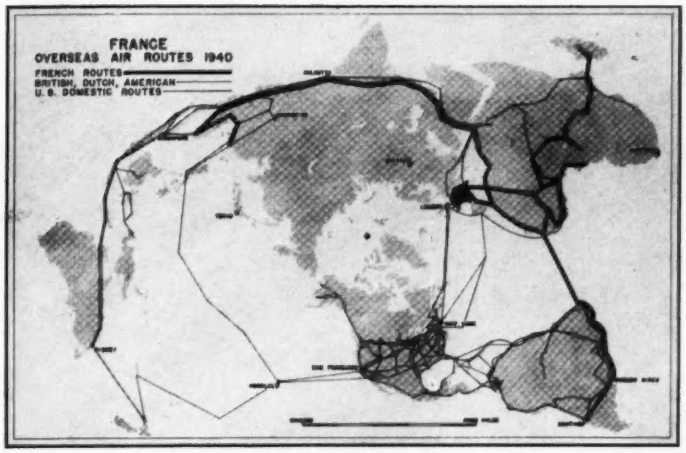

FIG. 33.—Routes of Air France. (Data from *ibid.*)

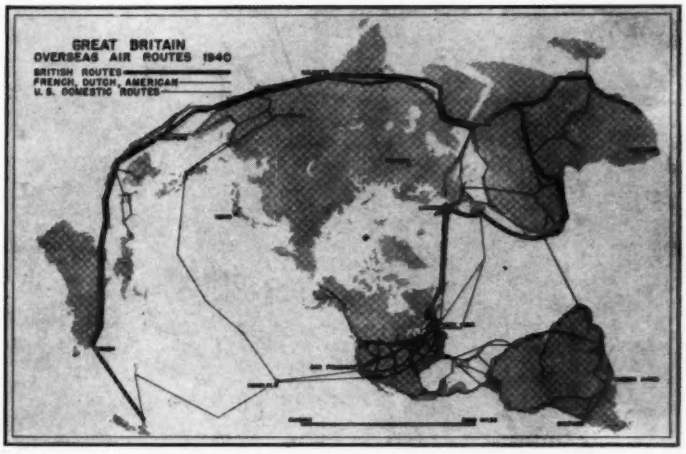

FIG. 34.—Routes of Imperial Airways. (Data from *ibid.*)

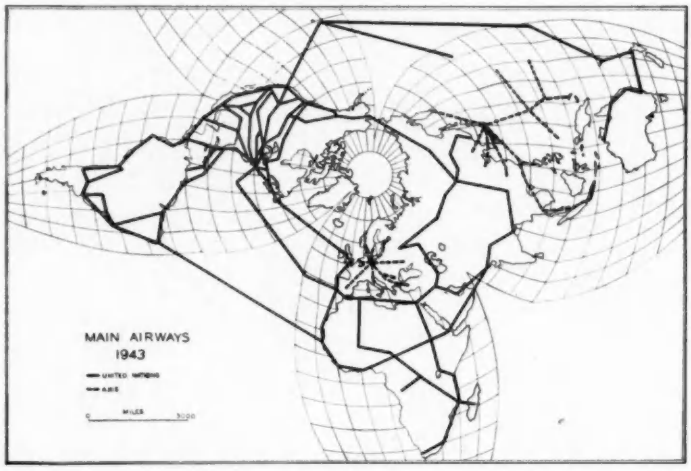

FIG. 35.—Wartime air routes, on interrupted polar projection. (*Base from Goode's Polar Equal-Area Projection, Base Map No. 201 PC, University of Chicago Press, 1939.*)

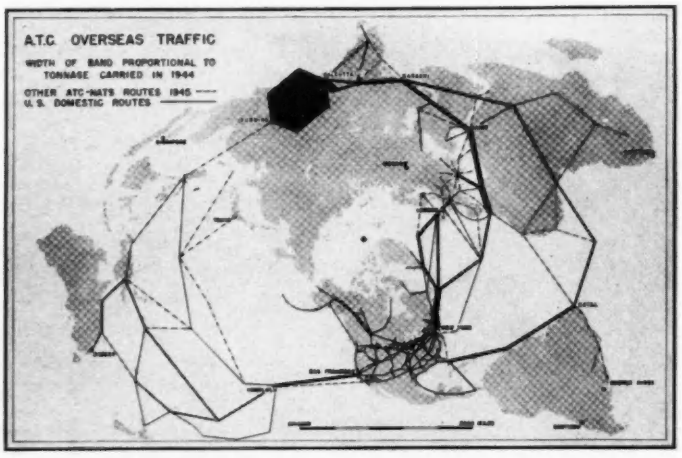
A.T.C. OVERSEAS TRAFFIC
WIDTH OF BAND PROPORTIONAL TO TONNAGE CARRIED IN 1944
OTHER ATC-NATS ROUTES 1945
U. S. DOMESTIC ROUTES

FIG. 36.—Wartime traffic of U. S. Army Air Transport Command. (Data from *Fortune*, Vol. 32, No. 2 [Aug., 1945], p. 162.)

FIG. 37.—American Overseas Airlines plane loading at Chicago. Mayor of Chicago going aboard for trip to London to put in Chicago's bid for capital of the United Nations, November 1945. View looking northwest; Hale School in left background. (*Acme Photo.*)

FIG. 38.—La Guardia Field, New York. Runways for taking off in six directions, omitting southeast-northwest. View looking northwest. (*American Airlines, Inc.*)

FIG. 39.—Washington National Airport. Runways for taking off in eight directions, one in each direction. View looking north, up Potomac. (*Acme Photo.*)

FIG. 40.—Pucallpa, Rio Ucayali, Peru. Airfield back of village; grassy runways for taking off in six directions. Air view looking north, downstream. December, 1935.

FIG. 41.—Nathan Hale School; east front facing airport fence. Kindergarten children. View looking north, air field in background. December, 1945.

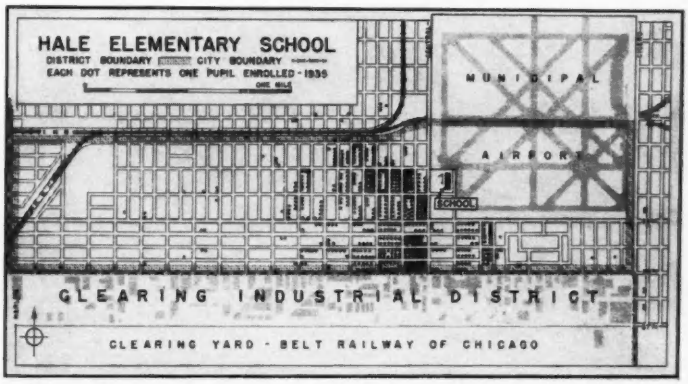

FIG. 42.—Nathan Hale School District. Since the time of this map (1935) houses have been built in some of the vacant blocks near the industrial district and registration in the school has nearly doubled. (Data from R. L. Grimes, Principal.)

FIG. 43.—Children in the school yard. Air field in background. December, 1945.

FIG. 44.—Older children in the school yard.

FIG. 45.—Business center, Hale School district. Business building at southwest corner of Section 16 is small dark structure farthest away on left. Airport hangars dimly visible in center. View looking east. December, 1945.

FIG. 46.—Homes in residential area, Hale School district. Three blocks west of school.

FIG. 47.—Small farm in the Hale School District beyond the border of the compactly built-up area, about a mile west of school. There are similar farms close to the airport, north of the built-up area.

FIG. 48.—Hale School field trip in a factory of the industrial district. (Grimes, R. L. & Kastendick, M.: "At Home Tours for Outlying Schools" in *Chicago Schools Journal*, vol. 22 [1941], p. 177.)

FIG. 49.—Field reports given in Hale School social-studies class. (Grimes, R. L. & Kastendick, M.: *op. cit.*, p. 178.)

FIG. 50.—Field reports in Hale School assembly. Map of industrial district indicated by pointer. (Robert L. Grimes, Principal; and Mabel Kastendick, Teacher.)

Climate and Man in China

CHI-YUN CHANG*

INTRODUCTION

In China, climate expresses itself explicitly in the landscapes of the country and the modes of human occupance and livelihood. It underlies the production, distribution and exchange of produce, influences methods of agriculture and differentiates zones of cultural features. The effect of climate has had the most far-reaching and persistent historical consequences. A study of the historical southward movement of the Chinese people will reveal a steady influx from the less favorable climatic regions into the more favorable lands. Each period of oscillatory desiccation in the north and the northwest, where the rainfall variability is the greatest of the whole country, might have been the underlying cause of each incursion from the north in Chinese history. The recent emigration to Manchuria and the South Seas from the over-populated Shantung and Hopeh, and Kwangtung and Fukien, respectively, indicates the significance of acclimatization and adaptation to the new habitats.

(1) SEASONS

Since China is located on the eastern side of the Eurasian continent, most of it has a continental climate which heats up notably in summer but becomes considerably cold in winter. The mean annual temperature varies greatly in different parts of China. In south China it is between 20°–25° C.; in the Yangtze Valley, 15°–20° C.; in the Hwang Ho Basin, 10°–15° C.; in south Manchuria, south Tibet, and Sinkiang 5°–10° C.; in north Manchuria, north Mongolia, and the greater part of Tibet below 5° C. The difference in temperature between north and south is much reduced in summer, but greatly accentuated in winter.

The mean annual temperatures of China are of moderate significance owing to the wide range of seasonal differences. Figure 1 illustrates the duration of the four seasons at 22 stations in China.[1] Winter is defined here as the period in which the 5-day mean temperature goes below 10° C.

* A previous article by Mr. Chang, "Geographic Research in China," appeared in these *Annals* (vol. XXXIV, pp. 47–62). The current paper is presented under the sponsorship of Dr. Charles F. Brooks.

[1] For details see Pao-Kun Chang: "With Duration of Four Seasons in China" (in Chinese with an English abstract), *Journal of the Geographical Society of China*, Vol. I, No. 1, Nanking, Sept. 1934. This article presents four original maps showing the dates of the beginning of the four seasons.

(50° F.); summer as the period in which it is over 22° (72° F.); while spring and autumn are the intervals during which the mean temperature lies between these two limits. According to this definition, the summer in south China and the winter in northeastern China last about eight months, and there is almost no winter in China south of Yungkia (Wenchow) in Chekiang Province, and almost no summer in places north of Pingkiang (Harbin) in Kirin Province.

The region noted for its equal distribution of the four seasons is the lower Yangtze Valley, where the duration of winter and summer is about 4 months each; while that of spring and autumn is about two months each. In the Hwang Ho Basin, winter is longer (five months), and summer is shorter (three months). In southwestern China, the topography plays an important part in climate. Thus the Yunnan Plateau, with an elevation of over 6,000 feet, lacks summer, but spring or autumn last eight months, and Kunming, the provincial capital of Yunnan, has the reputation of enjoying a "perpetual spring." The wet and dry seasons are more distinct and significant on the Yunnan Plateau than are seasons based on temperature.

China, situated on the margin of the largest continent, has predominantly monsoon winds, offshore in winter and onshore in summer. In winter the heavy, cold, dry air of Central Asia chills the Chinese; in summer the warm to hot muggy air from the tropical Pacific makes the people uncomfortably hot. Nevertheless, the monsoonal winds are not so constant as one would imagine; when cyclones pass over China, winds from every point of the compass may be experienced successively for a time.

As has been mentioned above, there is practically no winter south of Yungkia; frost is rare near sea level. But considering its latitude, south China is cool in winter on account of the winter monsoon blowing into the southernmost district, as far as Hongkong, at latitude 22°, where, indeed as well as at Canton, lat. 23°, snow and frost are occasionally experienced. January isotherms swing nearer the equator on the China coast than on any other coast of the same latitude on the globe (Figs. 2 and 3).

It is interesting to note that many climatic terms evolved in the north have been carried intact to other climatic regions although in many cases they do not fit. For instance, the Chinese calendar which contains the twenty-four periods has its origin in the Han dynasty. The calendar fixed the date of the first frost in autumn as October 24, which is probably the mean date of the first frost in the Central Plain 2,000 years ago. The average dates of the first and last frosts for Tungshan (Hsuchow) in northern Kiangsu are now October 23 and April 4 respectively (Fig. 13).

The main concentration of population in the Earlier Han dynasty (206 B.C.–8 A.D.) was in the Hwang Ho Plain. The later Han dynasty (25–

220 A.D.) saw a southward shift of population into the Yangtze Valley, although the Hwang Ho Plain remained the central nucleus. As the climate of Central and South China is more favorable for agriculture than that of north China, once the large-scale southward migration was started by some historic incidents, the more favorable environment tended to perpetuate the inhabitation and to heighten the civilization which accompanied the migration. The prosperity of the south began with the fall of Loyang in 316 A.D. when a number of eminent families and learned people moved southward across the Yangtze River. Since the late Tang dynasty (ninth century) the Yangtze Basin has been economically superior to the Hwang Ho Basin. The drive of the "Golden Hordes" into northern China in twelfth century made Hangchow the center of culture. Since then, regions in the southeast have become the most highly civilized parts of China. From the middle of the nineteenth century the Canton Delta, climatically belonging to the tropical zone, has produced a great number of eminent men. More recently, Canton had the honor of being the headquarters of the Chinese revolutionary movements.

It seems that the southward movement during the past twenty centuries was the main trend of the Chinese nation. This century however, shows a considerable northward migration into Manchuria, after the climatically favorable southeast region became rather saturated. The maximum rate of the population movement was in the period 1927 to 1929, when there were more than one million people entering Manchuria each year. South of Pinkiang (Harbin) most of the plain has only 150 or more frostless days. In northwestern Manchuria the growing season is reduced to less than 100 days. Such migration was somewhat paralleled by the southward emigration to the South Seas.

HUMID AND ARID REGIONS

As applied to China the use of the term "monsoon rain" is improper and often creates misunderstanding. For instance, in the Yangtze Valley, when the southeast summer wind blows consistently, drought is imminent. This paradoxical phenomenon is to be explained by the fact that rainfall in China is mainly cyclonic; most of the precipitation ocurs in association with cold fronts. A northerly or northeasterly air current is required to lift the southeast monsoon to a height of some 3,500 feet before it drops its quota of moisture.[2] As the findings of the observations conducted by Zikawei Observatory during the past sixty years in Shanghai show, regions with the least southeasterly winds had the wettest summers, while in a severe drought, the southeasterly winds persisted. Indeed, the ancient Chinese al-

[2] See Co-ching Chu: "The Enigma of the Southeast Monsoon in China" (in Chinese with an English abstract), *Jour. Geog. Soc. of China*, Vol. I, No. 1, Sept. 1934.

ways took the fresh steady southeast monsoon as an omen of drought. Weather proverbs are full of references to it, and the famous poet of the Sung dynasty, Su Shih (1036–1101) wrote a poem in praise of the southeast monsoon as a welcome sign of the cessation of the gloomy rainy season, which is known as Mai Yu or Plum Rain in the lower Yangtze Valley (Fig. 4). The Mai Yu, or the moldy period, occurs during the summer in the Yangtze Valley and South. The humidity is very high, and moisture condenses on all cool or saline objects (Fig. 14).

Of course there is no denying the fact that the southerly monsoons are the moisture-bearing winds to China. Though pregnant with moisture, however, they are powerless to deliver it to the thirsty land below until it is released by some mechanism. The mechanism may be aero-dynamical, thermal, or topographical; in the form of a tropical cyclone, a cold front, a heat thunderstorm, or a high mountain range. In a cold front it is the northerly winds which wedge under and release much of the moisture carried by the southerly currents above.

Extratropical cyclones are quite numerous in China. They travel from west to east but turn toward northeast on reaching the coast. Their tracks vary from season to season. South of latitude 25° N. very few cyclones occur. During April and May cyclones are most numerous in the Yangtze Valley, but during July and August north China is favored with more storms than central or south China. There are, on the average, eighty-four cyclones charted over China in a year.[3]

Typhoons are much more spectacular than the extratropical cyclones, but as a climatic factor they are not so important. This is because the number of typhoons is much smaller; only about four or five reach China annually. Even in Hongkong in summer the amount of typhoon rains attains only one-third of the total. The proportion of thunderstorm rain is smaller than typhoon rains in summer, but greater than typhoon rains in spring.

The rainfall of north China is scanty when compared with the northeastern part of the United States, almost identical in location and in latitude. The aridity of north China is due to the following four causes: (1) the decrease of the number of cyclones from south China to north China, (2) the deflection of the warm Kurosiwo current farther and farther away from the Chinese coast as we go northward from the Yangtze Estuary, (3) the presence of the mountain barrier of the Tsinling, and (4) the influence of Siberian anticyclones in the winter half of the year.[4] Of the four, the last two causes are the most important.

[3] Co-ching Chu: "Climatic Factors of China" (in Chinese with an English abstract), *Jour. Geog. Soc. of China*, Vol. II, No. 2, June 1935.

[4] Co-ching Chu: "The Aridity of North China: Its Causes and Consequences" (in Chinese with an English abstract), *Jour. Geog. Soc. of China*, Vol. I, No. 2, Dec. 1934.

The Siberian anticyclonic conditions are so well developed and so dominant in winter that very few storms invade the Hwang Ho Basin and Manchuria in that season. Hence, the weather is distinctly more settled than it is in the northeastern United States, and the rainfall is very light. Moreover, the region northwest of the line drawn from Peiping to Laokay (Yunnan-Indo-China border) through Ichang is spared from the tropical cyclones which enter from the south and pass northward along the east coast, many of them bringing large amounts of rain. Obviously typhoon rains decrease in importance from south to north and from the coast inland.

The Tsinling range is the barrier on which the moist winds from the Pacific lose much of their moisture and against which the cold and dusty northwesterly winds of winter break their force. If we take places located along approximately the same longitude but on the different sides of Tsinling, those situated to the south of Tsinling have two or three times as much mean annual precipitation as those situated to the north of it. Thus Hankow has a mean annual rainfall of 1,155 mm., while Kaifeng, on practically the same longitude but located to the north of Tsinling, receives only 566 mm.

In western China, mountain rain is of paramount importance (Fig. 7). The relatively heavy rainfall of mountain masses, in contrast with that of the surrounding lowlands, is to be accounted for by the upward deflection of winds by the mountains. For instance, Omei Shan rises at the western edge of the Szechwan Basin with a bold cliff to 10,170 feet, and the rain gauge at the summit registered 7,900 mm. in a year,[5] almost rivaling Cherrapunji, India (40-year average of 10,820 mm.) which is one of the two rainiest spots in the world, and which derives its heavy deluge from the same cause.

Rainfall is the most critical single element in climate, and a knowledge of its causes and characteristics is essential to a clear understanding of the climatic conditions of a nation. Generally speaking, areas with an annual precipitation averaging in excess of 750 mm. (30 inches) are called humid; those which normally receive less than about 250 mm. (10 inches) are called arid; areas with averages of 250 to 500 mm. (20 inches) are frequently clased as semi-arid, while those receiving from 500 to 750 mm. are sometimes called sub-humid. For the purpose of agriculture the three isohyetals, those for 250, 500, 750 mm., are viewed as separating the four rainfall grades: scanty, meager, sufficient, and abundant (Fig. 5).

(1) *Humid regions.* The 750-mm. isohyet stretches along the Tsinling Range and the Hwai Ho, and nearly divides China proper into two equal parts. The rainfall is heaviest on the higher land of the Nanling and nearer

[5] Observation made by the National Institute of Meteorology, Academia Sinica, during the Second Polar year, August 1932–July 1933.

the sea. This region has a more marked degree of cloudiness and humidity than the Hwang Ho Basin but a lesser degree of evaporation; hence, sensible temperatures are higher in summer and lower in winter. The flora of southern China is far richer than that of the majority of regions in similar latitudes. There is no dry season. Woodland vegetation is strikingly vigorous and extraordinarily varied. Bamboo, which lends itself to a wide variety of uses, is the typical plant (Fig. 17).

(2) *Sub-humid region.* The 500-mm. isohyet runs nearly along the western slope of the Great Khingan, Yenshan, and Taihang Shan and then turns west to the north of the Tsinling Range, from which it again deflects to the SSW and follows Tashuishan or the Great Snowy Range in Sikang, finally going up the Tibetan Plateau and extending along the Trans-Himalaya Range. The windward side of the mountains has more precipitation than the leeward, and the landscapes are very different. Peculiarly, erosion and gullying is faster on the dry side. The binding power of vegetation seems to more than offset the erosive power of the rain and rivers on the wet side.

North China's meager precipitation is remarkably concentrated in the six months of the growing season. South and east of Pinkiang (Harbin) in Manchuria the precipitation is more than 500 mm., declining only very slightly to the north but more markedly to the west. Considering the meager amount of precipitation, it is very fortunate that 65 per cent in southern Manchuria and 75 per cent in northern and western Manchuria falls in the four months of the growing season.[6] Yet, since the beginning of recorded history, there have been periodic occurrences of drought and attendant famine.

(3) *Semi-arid region.* The 250-mm. isohyet coincides approximately with the trend of Yinshin, Holanshan, and Chilien Shan (or Nanshan). This region, comprising the Upper Hwang Ho Basin and a part of Inner Mongolia, would be called a steppe according to Koeppen's definition. Most of the rain falls in the warm season. In the high mountains there is some increase of precipitation as the result of ascending winds, and forests are generally found in the Chilien Shan. The region is sunny, and the sensible effects of the extremes of cold are therefore moderated by the direct radiation of the sun. The daily range of temperature is great. In this region farming is possible only under irrigation, and evaporation is so intense that the farmers near Lanchow usually strew pebbles or chipped porcelain on the fields to reduce evaporation (Fig. 9).

(4) *Arid regions.* To the west and north of the 250-mm. isohyet stretch

[6] N. Murakoshi and Glenn T. Trewartha: "Land Utilization of Manchuria," *Geographical Review*, July 1930.

vast expanses of the Gobi Desert, where the mean annual amount of precipitation is recorded as less than 40 mm.[7] Sunshine prevails throughout the year, relative humidity is low, and evaporation is high. The nights commonly are cold, even when the days are hot. The heat of summer is great, but in the dry wind it is not oppressive. Oases of culture are to be found in the foothills of high mountains where the melting snow and rainfall in the mountains make the raising of crops possible. Farmers in the Kansu Corridor, known as "HoHsi" (west of the Hwang Ho) in Chinese history, welcome the sunshine but abhor Chilien cloudiness; they are dependent upon melting snow from the Chilien Mountains for irrigation.

In most of Central Asia the drainage is concentric into many separate basins of different elevations (Fig. 8). Much of this water seeps under the silt and gravel of the basins and the occasional springs and wells all over Mongolia are the meeting places of the desert. Here the Mongols gather to water their stock, exchange gossip, and distribute news (Fig. 11). These locations are carefully indicated on maps. The climate is severe. During the winter the temperature drops to 40 or 50 degrees below zero C., and the plateau is swept by bitter winds from Siberia. Here the food supply is scanty and of little variety. In time of drought, nomadic groups are in danger of extinction and therefore raids are practically the only means of keeping themselves alive. Thus for untold generations the nomads of the steppes and deserts of Central Asia have been subjected to rigorous biological selection which has produced a definite type of bold, soldierly, and dominating people. The region was in the past the ranging grounds of warlike tribes, like Hsiung-nu (Huns), Tu-chueh (Turks), and Mongols, and the starting point of those great racial migrations which changed the face of China as well as of Europe. This helps to explain the military significance of the Great Wall (Fig. 12).

(3) AGRICULTURAL BELTS

In China climate is the main control of agriculture; rainfall matters a good deal, so does temperature. A working scheme of six belts is presented below (Fig. 15):

(1) *Rice belt (triple crop)*. This belt lies south of the Nanling Range. Annual precipation exceeds 1,000 mm. and is usually over 1,500 mm. The growing season lasts for the whole year. Tropical fruits like lichee, bananas, and pineapples grow well, and in Hainan Island palms occur. Three crops of rice are raised yearly, supporting a very dense population (Fig. 16).

(2) *Rice belt (double crop)*. This belt lies south of the 1,100 mm. line,

[7] This is the record of Etsingol in Ningsia Province for the period 1927–1929, according to observations made by W. Haude of the Sino-Swedish Scientific Expedition.

which is roughly parallel to the Yangtze. The growing season lasts for eight to nine months. Farmers are able to grow two crops of rice a year, and the fields are usually kept under water for most of the growing period. Mulberry, the basis of the silk industry, tea, and the tung oil tree grow in profusion.

(3) *Co-existing rice and wheat belt.* This region lies to the north of the preceding belt, its northern boundary roughly coinciding with the Tsinling and the Hwai Ho. Here the annual rainfall is between 750 and 1,000 mm., with at least eight months of growing season. It is a transitional zone between the rice and the wheat-growing countries (Fig. 21). In Nanking wheat is usually planted by October tenth and harvested by June first. The September rainfall forms the moisture background of the seedling. Cotton is grown as a cash crop in summer, rape-seeds and beans are sown in winter. The Yangtze Delta, with its apex at Nanking, is the most densely populated region in the whole of China with an average of more than 1,000 people per square mile. An aerial view reveals it as a continuous mosaic of cultivated fields, on which villages almost touch each other (Fig. 19).

(4) *Winter wheat and multiple cereals belt.* This belt is bounded by the 750-mm. isohyet on the south and the January isotherm of 6° C. on the north, which corresponds to a line drawn from east of Peiping southwestward through the central parts of Shansi, Shensi, and Kansu Provinces. The growing season lasts six or seven months. Rainfall is inadequate for rice, so wheat and drought-resisting cereals dominate. Wheat is sown in the fall; beans are grown as the chief supplementary winter crop. Kaoliang and millet are grown in summer, with corn, barley, etc., as secondary summer crops, hence the name of multiple cereals. In alluvial plains such as the Wei Ho and Fen Ho basins, cotton is grown. Sunshine is required for the satisfactory maturing of cotton and wheat, and thus northern China with its sunshine in the late spring and early autumn is favorable to both of these crops (Fig. 20).[8] The average population density of the North China Plain is about 770 per square mile, as a wheat region cannot support a population as dense as a rice region (Fig. 6).

(5) *Spring wheat and multiple cereals belt.* Farther north is the spring wheat region. Winters are cold and the snow is light, and wheat is not sown until the ground thaws out in the spring. Also, because of the shorter growing season, which is less than five months, one crop a year is the rule. In addition to wheat, soy beans, kaoliang, millet, corn, barley, and oats are also important. In Manchuria the soy bean occupies about one-fourth of the total cultivated land and ranks first in acreage. Both upland and paddy rice are grown in the eastern part of Manchuria. Cultivation of the rice

[8] J. L. Buck: "Land Utilization of China," Nanking, 1937, vol. 1, p. 3.

crop is chiefly by the Koreans, who consume it locally and sell it to the Japanese in the cities.

(6) *Oasis belt.* People dwell in towns at the foot of the mountain range where the sloping alluvial plains may be rendered immensely productive by irrigation. The growing season of the Tarim Basin lasts for seven months, the same as in the Hwang Ho Basin, but no winter crops can be grown here on account of the severe cold. The combination of heat and irrigation is conducive to a vigorous growth of vegetation. Rice, wheat, cotton, mulberry trees, grapes, watermelon, and so forth, are abundant to an unusual degree. Groves of poplars, willows, and other trees add their verdure to the ribbons of green fields in striking contrast with the neighboring yellowish gray desert (Fig. 10).

(4) DROUGHT AND FLOODS

North China, one of the most important regions of China, is a land of frequent drought and floods. In some years the crops fail through drought, and in other years the rain is so excessive that the rivers burst their banks, bringing an immense devastation; crops are destroyed and people drowned by thousands (Figs. 22 and 23).

Rainfall is most reliable in South China where the visitations of cyclones are frequent and regular. The least favored is the loess plateau, where a variation of over 30 per cent is the rule, and in places it is well over 40 per cent.[9] Thus the rainfall of the loess plateau is not only scanty—below 500-mm.—it is also unreliable. Taken as a whole, the rainfall variability for most of North China exceeds 20 per cent; no other part of the world with a population as dense as that of North China has such a high rainfall variability. The seasonal distribution of rainfall is as follows: spring (March–May) 10%, summer (June–August) 70%, autumn (September–November) 7%, and winter (December–February) 3%. In normal years, spring rains are usually enough to germinate spring-sown seeds, to mature winter wheat, and to carry other crops through their early stages of growth. In years when the spring rains fail the wheat crop is meager and the people go hungry, but a second crop of vegetables, beans, etc., often carries the people through the winter.

At Yangku (Taiyuan), the provincial capital of Shansi, the annual rainfall mean for sixteen years is calculated at 390 mm. For the year 1934, the annual total was 465 mm. Quantitatively, the year 1934 obviously has a positive departure of 77 mm. over that of the mean. At first sight the year may seem one of heavy precipitation, yet it was actually a poor one for Tai-

[9] Huan-Yong Hu: "The Climate of the Hwang Ho Valley" (in Chinese with an English abstract), *Jour. Geog. Soc. of China*, Vol. IV, No. 1, March 1937.

yuan, agriculturally. Deficient rainfall early in spring did not give the crops a chance to be planted and developed on time. This was followed by excessive rain which was harmful to the growth of plants. As if to ruin the crops thoroughly, then came the frost which killed them before they reached maturity. Thus equally injurious conditions at opposite extremes, namely, the deficiency and the excess of rainfall, have often caused great damage to the crops. The question of seasonal variability is more important than the annual variability.

South of the Yangtze the spring variability is below 20 per cent. In the Yangtze Valley it has an average of about 25 per cent, while in North China it ranges from 40 to 60 per cent.[10] It is obvious that during the spring season rainfall in North China is the least reliable, yet spring is the planting season. Prolonged exposure to drought hinders the slow process to maturity so necessary to the crops before the killing frost comes; even plentiful rainfall in the preceding summer would be of no avail.

At Siking (Sian), the capital of Shensi Province, the mean annual rainfall for the eleven years is 532 mm., which is about the same as for Paris and London. Therefore, as far as the mean annual rainfall is concerned, it may be regarded as sufficient. Famine is due to the exceptionally uneven distribution of dry and wet years, for in the eleven years recorded the maximum is 764 and the minimum 295 mm. Again, the monthly distribution of rainfall has a great deal to do with the recurrence of famine. The year 1929 had 764 mm. of rainfall, the maximum of the whole series of eleven years, yet Shensi suffered from drought that year. The rainfall of July that year was zero instead of the normal 74 mm. This being the most important growing season, crops naturally failed in spite of the unusually large amount of rain that came in the following month. In fact, practically all the famines from 1928–1930 in North China were due to the lack of rain during the months of July and August rather than any decrease of annual rainfall. The drought of 1920–1921 in northern China is estimated to have killed 500,000 or more people and to have rendered 20,000,000 destitute.

The enormous loss of life and damage to property caused by floods in North China is well known. In 1924 about 25,000 square miles of Hopei Province were under water, and it was estimated that nearly 5,000,000 people were homeless. Between Tientsin and the Taihang Shan is the meeting ground of five rivers, and a great quantity of silt is brought down from the mountains; this raises the level of the river bed. The waters are restrained by embankments or levees, and the opening of a gap often causes flooding of the river over a wide area of the country. The average rainfall

[10] En-lan Liu: "Rainfall Variability of China" (in Chinese with an English abstract), *Jour. Geog. Soc. of China*, Vol. III, No. 3, September 1937.

is about 500 mm. a year, 90 per cent of which is received in the five months from May to September. In the summer of 1924 the rainfall was abnormally heavy; at Peiping the fall in July was 650 mm. and at Tientsin 800 mm. fell in three weeks. These heavy rains broke numerous gaps in the river banks, causing disastrous floods over all the low-lying country.

Excess of rain rather than drought constitutes the general climatic problem in the Yangtze Valley. It had 56 floods during the period 1911–1932, of which 42 were due to cyclonic storms, nine were due to typhoons and five to thunderstorms.[11] The floods of the middle and lower Yangtze in 1931 were unparalleled in the present century. In July of that year there was extraordinary cyclonic activity.[12] In twenty-three rainy days in Nanking, the rainfall totalled 620 mm., i. e., three times normal. The average maximum inundation of the fields was nine feet. In this flood 25 million people in 131 districts of six provinces were affected. The number of deaths from drowning was 140,000. Calculations from all available data place the total loss at $500,000,000 (American currency), much heavier than the losses caused by the flood of the Mississippi in 1927, which amounted to $300,000,000. Following the great flood of 1931, dikes were constructed or rebuilt and repaired along the banks of the Yangtze Kiang below Wu-han for a distance of 1,140 miles.

The maximum rainfall comes mostly in May in Northern Kwangtung, mostly in June in the Yangtze Valley, and practically always in July in North China, in unison with the shifting of the belt of most frequented cyclonic tracks with their corresponding cold fronts.[13] This explains the common connection of the droughts in the Yangtze Valley associated with a season of plentiful precipitation in North China. The unprecedented flood of the Yangtze Valley in 1931 was accompanied by a drought in North China at the same time. In the summer of 1934, however, the Yangtze Valley suffered one of the worst droughts of recent years, while parts of Manchuria and North China were inundated.

Typhoon rains are confined to narrower limits of time and space than the cyclonic rains. There are about four or five typhoon visitations to China annually. The southeastern coastal region feels the fullest strength and violence of the typhoons. The highest hourly wind velocity in a typhoon recorded is 75 miles (observed on July 28, 1915, at Zikawei Observatory,

[11] K. Y. Cheng: "Floods and Rainfall along the Yangtze Valley during the Period 1911–1932" (in Chinese), *Science*, Vol. 18, No. 10, Shanghai, 1934.

[12] *Monthly Meteorological Bulletin*, July 1931, National Research Institute of Meteorology.

[13] Chang-wang Tu: "China Rainfall and World Weather," *Memoir of the Royal Meteorological Society*, Vol. 4, No. 38, London, 1934.

Shanghai). As a consequence, trees and houses are overturned, ships thrown up on the shore or engulfed. While the violent part of the storm area may be only 30 or 40 miles in diameter, the less violent parts may spread over a diameter of several hundred miles and cause a large amount of precipitation which often results in a flood. Typhoons, however, are not all harmful in effect. During the period of drought and excessively hot spells, they are much welcomed by the inhabitants, because of the refreshing winds and much-needed rainfall they bring. Much damage is done by the surf during the high tide, and maritime dikes are constructed to protect the fields from inundation by salt water. Among these the famous Hangchow sea dams were built by the State of Wu-yueh in 910 A.D., although the oldest part of the dikes along the northern shores of Hangchow Bay already existed in the Tang dynasty (618–906 A.D.). The Kiangsu and Chekiang Province sea walls perform the useful function of protecting the lives and properties of the inhabitants along the seashore.

(5) MOUNTAIN CLIMATE

The effect of mountains on the climate and on the location of settlement is readily seen in the ascent to the Chilien Mountains: the agricultural zone is essentially below 5,000 feet; 5,000 to 7,500, agriculture or forest; 7,500 to 10,000, pasture or forest; 10,000 to 12,000 feet, pasture.[14] The mountain systems are complicated and varied in character, so much so that their features can not be summed up in a few sweeping general statements. The following general observations, though by no means adequate, will suffice for our purpose. The three-fold subdivisions into Alpine grassland, coniferous forest, and mixed or deciduous forest, in descending order, seems applicable to all these localities with great elevation. Conspicuous mountain glaciers are confined to the Himalaya, Kunlun, Tien Shan, and the Chinese Alps in Sikang. In the high Himalaya the snow line lies above 16,000 feet, and the glaciers terminate above 10,000 feet (Fig. 24).

The borderlands of Yunnan and Sikang Provinces of southwest China have three recognizable altitudinal forest zones: pine, spruce, and larch-fir. In general, below 10,000 feet Yunnan pine is the predominating species, while the Chinese white pine is of less importance; between 10,000 and 12,000 feet the Likiang spruce predominates and prickly oak also reaches its best growth; from 12,000 feet up to the timber line (about 15,000 feet), pure stands of fir and larch are found.[15]

[14] Wen-hao Wong: "The Outline of the Geology of China" (in Chinese), *Science*, Vol. 13, No. 2, February 1927.

[15] S. C. Teng: "Studies of Chinese Timber Trees in Reference to Forest Management, I," *Sinensia*, Sept. 1940, published by the Research Institute of Zoology and Botany, Academia Sinica, Peipeh, Szechwan.

The zonation of a high mountain is a classification of more than geographic interest; it is of political import in Yunnan. Here, in secluded valleys, live small communities of different aboriginal tribes. Broadly speaking, the Shan people are acclimated to a warm, low country below 2,500 feet above sea level; the Mon group is found between 2,500 and 5,000 feet; while the Lolos and Mosos are at altitudes of 5,000 to 8,000 feet. But in Yunnan province the region between 5,000 and 6,500 feet, where the climate is mild and the surface relatively level, is occupied mainly by the Chinese (Fig. 25).[16]

Practically all the mountains of China have moister climates than the surrounding hills and valleys. In the foregoing pages mention has been made of the great amount of orographic rain on Omei Shan. Sometimes the actual precipitation is not conspicuous, but the frequent fogs keep the soil much more moist than surrounding regions. Clouds and fogs are especially common in the tea-producing districts in the Nanling ranges, and the soils of these hilly lands show the effects of being subjected to continuously moist conditions (Fig. 18). Indeed the tea of best quality is produced in Hwang Shan (5,400 feet), Anhwei Province, and is called the "cloud-and-fog tea."

A prominent feature of the landscape in northwest China is the difference in vegetation between the sunny side and shady side of the mountains, which are termed "yang" and "yin" slopes by the Chinese geographers. The southward-facing, or yang slopes, receive a greater amount of insolation than the yin, or northward-facing, slopes. As a consequence, the soils of the yin slopes are constantly cooler and contain a much higher percentage of moisture than the yang slopes. Hence, there is a considerable difference in vegetation under similar conditions of rainfall. Where the yang slopes are covered with short-grass vegetation, corresponding yin slopes are covered with long grasses and brush; where the yang slopes are covered with tall grasses and brush, yin slopes usually have a forest vegetation. In the Liupan Shan and other mountains of northwestern China this phenomenon is common.[17] On the higher mountain tops rainfall is often sufficient for both slopes to be forested, but on lower slopes forests are well developed only on the northerly hillsides.

(6) CLIMATE CHANGES

The historical literature of China is full of references to the weather; records relating to climatic change are common. Dr. Co-ching Chu, after a

[16] Johnson Ling: "Geographical Distribution of the Tribes of Yunnan," *Jour. Geog. Soc. of China*, Vol. 3, No. 3, Sept. 1936.

[17] James Thorp: *Geography of the Soils of China*, National Geological Survey, Nanking, 1936, pp. 37, 53.

careful research based on phenological data, frequency of flood and drought, dates of early frost and snow, number of severe winters and facts shown by instrumental records, discovered that the climate of China has been varying from century to century to an appreciable extent. He divides the total number of droughts in any century by that of floods, and calls the result the drought-to-floods ratio. When the quotient is above 2.25, the period it represents is considered dry; if below 1.10 it is considered wet. According to Dr. Chu's findings, the quotient of floods to droughts ranges from 1.04 to 8.20 per century; that of severe winters from 9 to 35. From these results Dr. Chu drew the conclusion that there have been "pulsations" in climate, but no definite trend toward desiccation.[18] Drought famines and flood famines are as old in China as her history.

The research on the records of drought and floods in Shensi Province, undertaken by Dr. V. K. Ting, reveals that during the 1,200 years from 700 to 1900 A.D. three main periods are definable: a wet period of 500 years (700–1100), followed by a dry period (1100–1500), which is succeeded by another wet period (1500–1900). The length of each period is about 400 years. In any case, figures indicate oscillation rather than desiccation.[19]

The instrumental records, which cover a relatively short period, testify to a very slight rainfall change which presumably took place between 1841–1874 and 1915–1924. The mean annual temperature differs only by 0.1° C. between the two periods. The results of a thorough investigation conducted by T. C. Cheng point to the existence, in historic times, of several important climatic fluctuations, but there is no evidence that drought will become more frequent or more disastrous.[20]

The Tarim basin of Sinkiang as a whole is a classic ground to study the baffling problems relating to the mutability of climate. Ellsworth Huntington's theory of desiccation, which purports to be an explanation of the great folk wanderings of the Asiatic tribes in medieval times, is based on the observations he made partly in this Tarim Basin.[21] However, the archeological and physiologic evidence gathered by Sir Aurel Stein and more recent travelers is contradictory and inconclusive and reflects the complexity of the problem. In order to account for the survival, in a state of almost

[18] Co-ching Chu: "Climatic Pulsations during Historic Time in China," *Geographical Review*, April 1926, and "Climatic Changes during Historical Time in China," *Gerlands Beiträge zur Geophysik*, Vol. 32, 1931, pp. 29–37.

[19] V. K. Ting: "Notes on the Records of Droughts and Floods in Shensi, and the Supposed Desiccation of N.W. China," *Geografiska Annaler*, special number, Stockholm, 1935.

[20] T. C. Cheng: "The Climate of Peiping During Recent Two Hundred Years," *General Report of Academia Sinica*, Nanking, 1932.

[21] E. Huntington: "The Pulse of Asia," Boston, 1907.

perfect preservation, of a multitude of objects which are perishable by nature, in such exposed places as refuse heaps outside residential buildings, Stein finds it necessary to assume that such conditions of extremity as are existent today already prevailed in ancient times. For example, near Lop Nor, among relics found in the grave pits of the walled Chinese station of Loulan (dating from about the time of Christ), there was disclosed by Stein a mass of remarkable textiles, including fine specimens of the earliest-known Chinese silks. Yet there is abundant and convergent antiquarian evidence proving that during the historical periods with which we are concerned, the rivers of the Tarim Basin carried a greater volume of water than they do now. These two theories do not seem to hang together, and three important explanations may be cited here: shrinkage of glaciers, migration of lakes and rivers, and the accumulation of alkali salts in the soils.

The diminished volume of the rivers, so Stein thinks, is due to the shrinkage of the glaciers on the high ranges which mainly feed those rivers. To account for the phenomenon of shrinkage, Stein assumes that those glaciers comprise great reserves of ice which have been left behind by the last glacial period and have since been undergoing slow but more or less continuous reduction through milder climatic conditions. Thus this process of exhaustion of what might be called "fossil ice" explains the shrinkage in the sources of irrigation during historic times, in the absence of appreciable change in the climate of the Basin as a whole.[22]

Gathering items from his discovery in 1900 and 1901 of the ruins in the northern part of the Lop desert and his research in the physiography of that desert, Sven Hedin arrived at the conclusion that Lake Lop Nor changes its position between the northern and southern part of the Lop desert. After a study of the conditions and laws of those changes, he was even able to foretell, as early as 1903, that a new change in the position of the lake was bound to take place in the near future. Sven Hedin was also the first explorer to learn, in 1928, that about 1921 his prediction had really become true: the river had returned to the northern part of the desert. As pointed out by him, the grand-scale wind erosion seemed to be a main condition for the river and lake displacements; the silt blowing off produces hollows for new water courses and lakes. The Etsingol basin of Ningsia Province furnishes another example of alternating lakes.

The general sequence of the changes of the river beds and lakes of the Tarim Delta seem to be thus: A delta region, when it is filled up with sediment, becomes less accessible to inflowing waters, so that the river tends to an easier way in other directions. This leads to a drying up of its previous courses. The region of fine mechanical sediment thus laid dry becomes

[22] Sir Aurel Stein: *On Ancient Central-Asian Tracks*, London, 1933, pp. 29–30.

wind eroded and more or less cleared out and made ready to receive water and sediment again. Thus for a given part of the delta, periods of sedimentation and periods of erosion interchange.

The old delta of the Tarim in the Loulan region was once inhabited by a permanent and highly organized population, with farms and fortifications and a strong military town. This fact was discovered and carefully studied by Sven Hedin. Even more significant than the local settlement was the through traffic. The old river together with its terminal delta was of fundamental importance to the communication between East and West. Along that river and through the Loulan region ran the old Silk Road. Over that road caravans took silk from China to Rome, and along the same route Western influence reached the Far East. The navigation of rivers and lakes, as events often show, may exert great influence on the migrations of people which are themselves far-reaching in effect. Old roads had to be abandoned and new ones sought whenever old towns and villages had been reduced to a heap of ruins in a thoroughly sterile desert. When drastic changes in the hydrographic system took place, as for instance those which occurred some 1,600 years ago resulting in the drying up of the northern river as well as the translocation of Lop Nor, life was no longer tolerable in what used to be the extensive Loulan oasis. Up to the present, after the return of the river to its northern course, the region is still not ready for settlement. Through wind erosion the district has been so intensely cut up by yardangs that any farming is out of the question for the time being, and even to nomads the region is unattractive.[23]

Studies on Lop Nor and Etsingol shed light upon the climatic changes in prehistoric time. Probably the maximum extent of the lakes corresponds to the ice age. Also in later times considerable fluctuations of the weather conditions from one year to another or from one set of years to another, are noticeable everywhere. But according to some authorities no observations on the sediments or the previous distribution of plants, animals, and man necessitate the assumption of a progressive change to a drier and drier climate in historical time.[24]

In great parts of Kansu and Sinkiang sufficient evidence can be found to prove that the accumulation of alkali salts in the soils was instrumental in bringing about the abandonment of farms and cities. When the deserts are subjected to irrigation, the water table is raised and salts are brought to the surface by capillary action and evaporation. In most of the Kansu Corridor

[23] Yardang is a Turkish name meaning furrows cut deep by the action of wind between sharp ridges of clay.

[24] Nils G. Horner and Parker C. Chen, "Alternating Lakes," *Geografiska Annaler*, special number, Stockholm, 1935.

the cultivated land is now confined to narrow strips along the relatively high natural levees bordering the streams. The lower lands of the river flood plains are scarcely suitable for agricultural crops on account of their extreme state of salt-saturation.

The majority of the grasslands along the borders of Inner Mongolia and the Ordos Desert, as well as in Kansu, have been plowed and cultivated. A great part of this land is sandy; and the accumulation of sands into dunes and their movement over the country follow in quick succession the destruction of grass roots by cultivation. Thus conditions similar to those of the desert have been produced, not by climatic changes but by the work of man in upsetting the balance of nature without taking proper precautions to compensate for the changes which are thus effected. Accordingly, near Yulin in Shensi and north of Wuwei (Liangchow) in Kansu and in many other places, desert conditions are being produced even when there has been no change in climate.[25] So far, no satisfactory evidence, either theoretical or factual, has been advanced testifying to the alleged change of climate in bringing about a pronounced degree of aridity over the whole of North China.

[25] J. Thorp: *op. cit.*, pp. 43, 464.

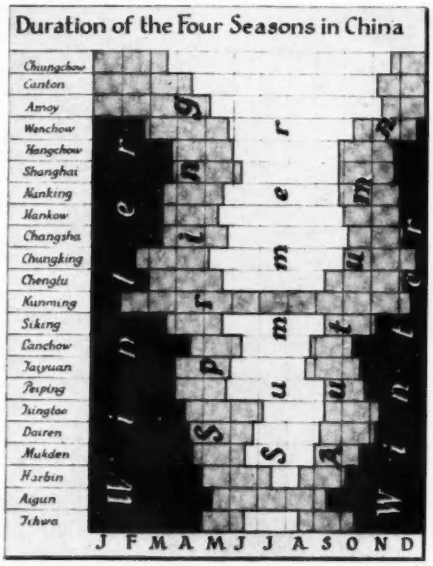

FIG. 1.—Duration of four seasons in China.

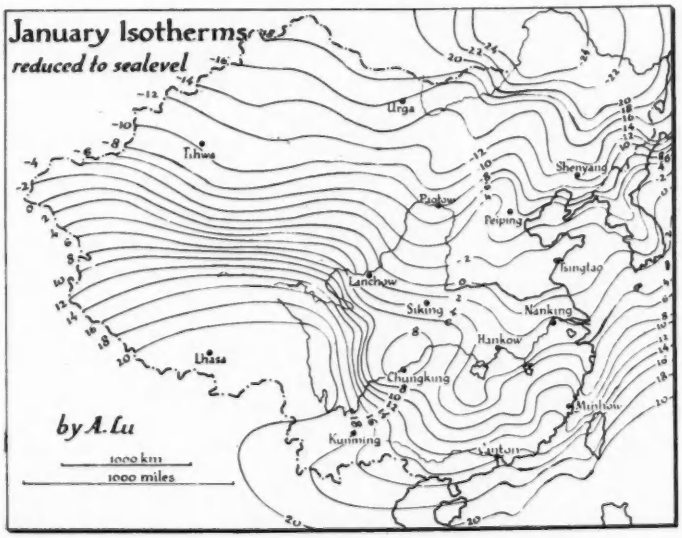

FIG. 2.—January isotherms.

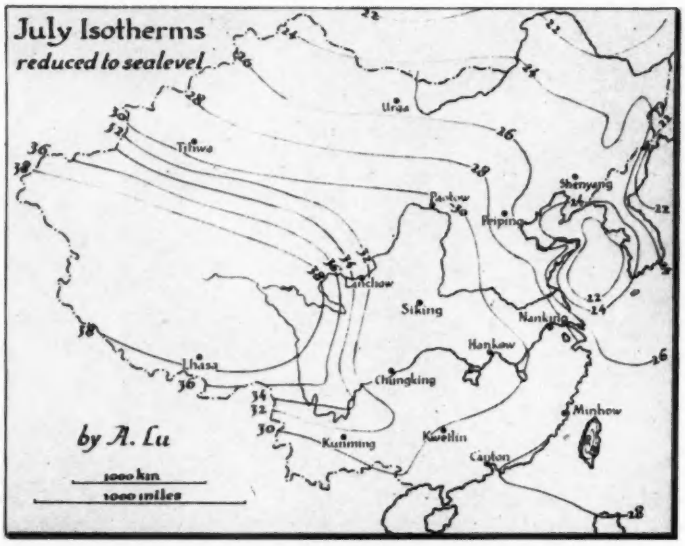

FIG. 3.—July isotherms.

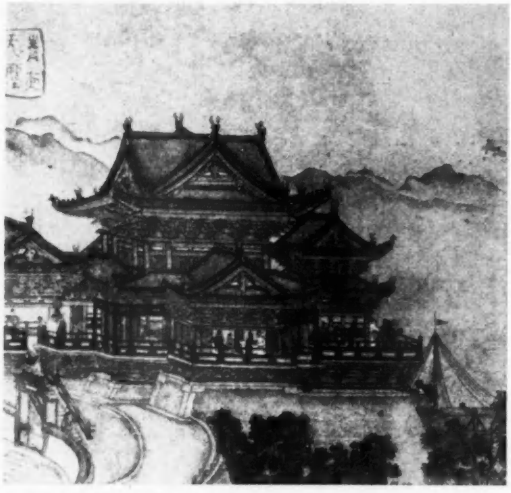

FIG. 4.—Yellow Crane Chamber, Wuchang Hupeh Province, production of the Painting Academy of Sung Dynasty (960–1279 A.D.). The characteristic Chinese roof with concave ridges which converge into a massive horizontal bar, and the far projecting and up-turned edges, are traceable to the Earlier Han Dynasty (206 B.C.–8 A.D.). The side projection was allegedly to protect the building from rain and storm and other inclemencies of weather, while the up-turned part was to admit more sunlight into the room.

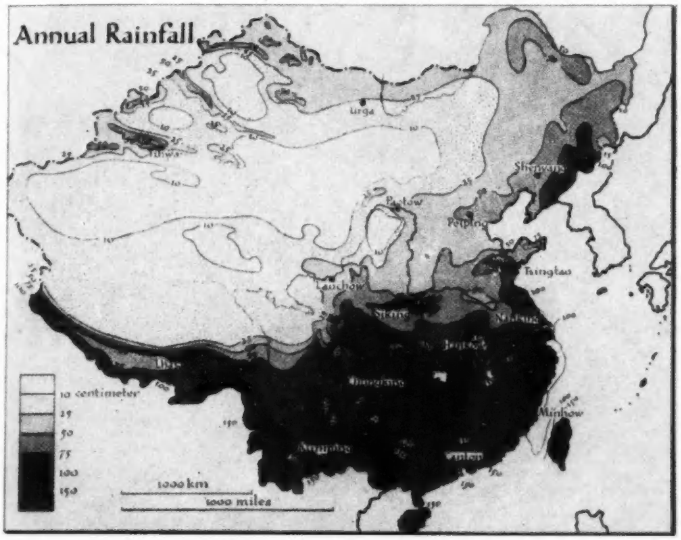

FIG. 5.—Map of annual precipitation of China.

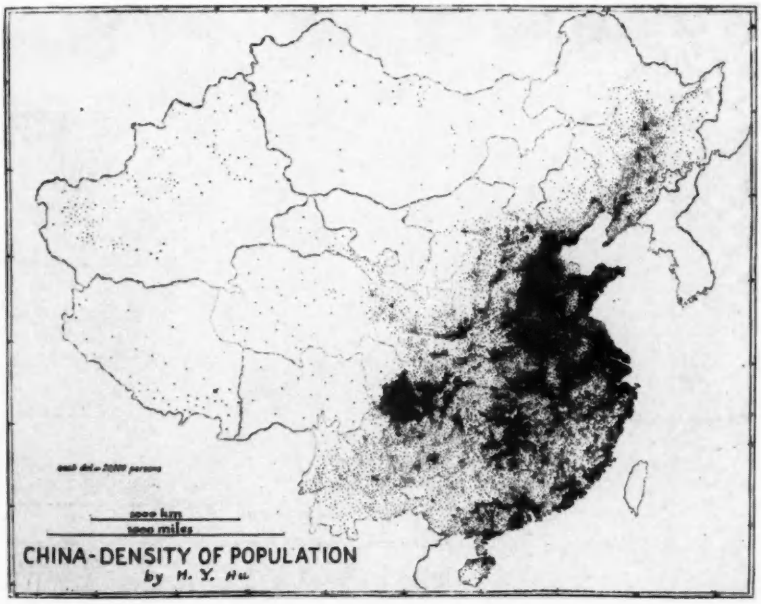

FIG. 6.—Dot map of population distribution in China.

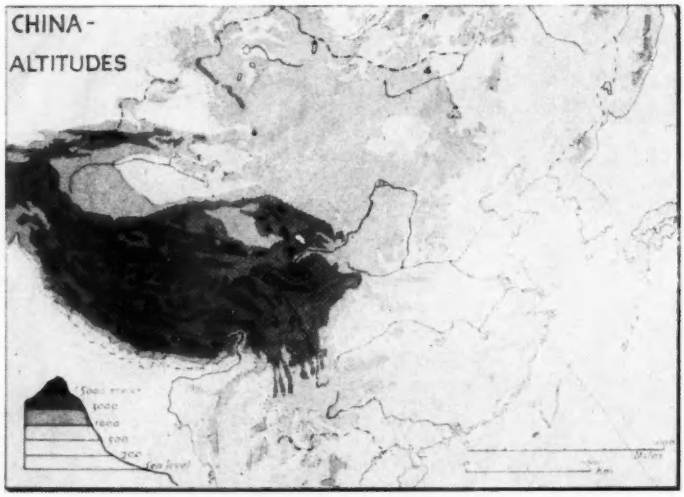

FIG. 7.—Relief map of China.

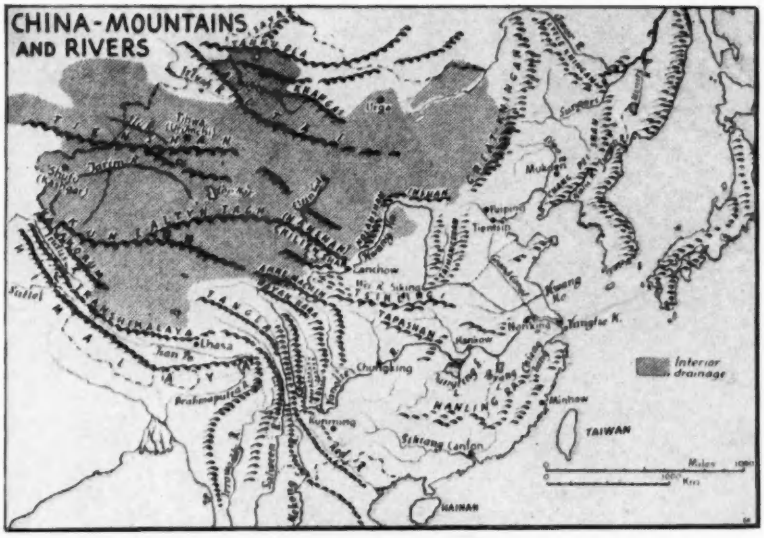

FIG. 8.—Interior drainage of China.

FIG. 9.—Pebble-strewn fields on the bank of the Yellow River, Lanchow.

FIG. 10.—The oasis of Tunhwang, in the western end of the Kansu Corridor.

FIG. 11.—The Tibetan pasture near Librang, southwestern corner of Kansu Province, 9,000 feet above sea-level.

FIG. 12.—Rainfall and frontier peoples of China.

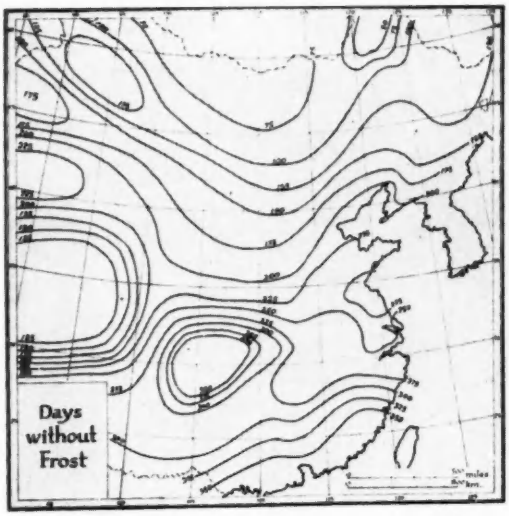

FIG. 13.—The duration of growing season in China.

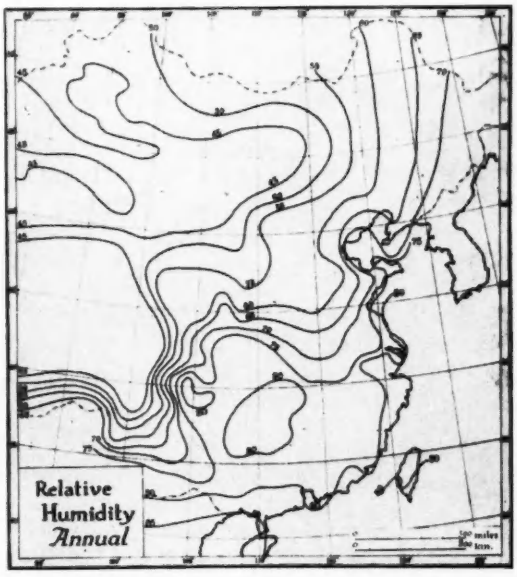

FIG. 14.—Average annual relative humidity.

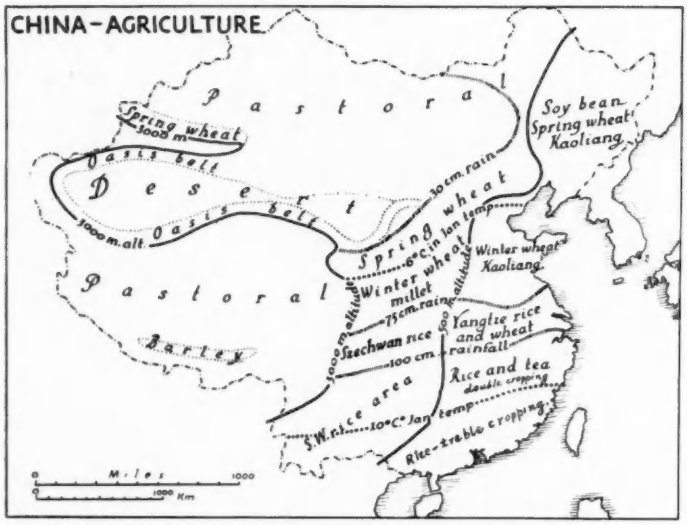

FIG. 15.—The agricultural regions of China.

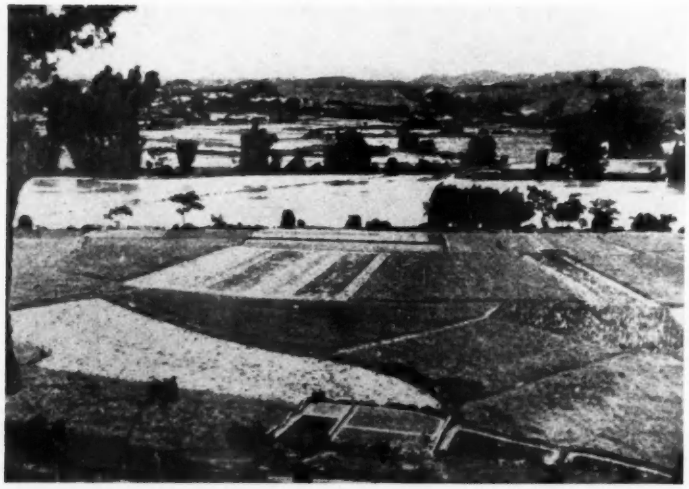

FIG. 16.—Terraced fields in Shunyi Hsien, Kwangtung Province. In the foreground on the slope are some pines. Near the hill on the plain, rice is either ready to be harvested or in rice seed beds. Toward the river bank are some fields of beans which will be followed by a crop of sweet potatoes; along the river bank are clumps of bamboo. (By courtesy of National Geological Survey.)

FIG. 17.—Bamboo groves near Hangchow, Chekiang Province.

FIG. 18.—The highest peak of Huang Shan, or Yellow Mountain, Southeastern Anhwei Province. The Chinese landscape artists learned how to portray mists in the mountains by observing them in such beauty spots as this.

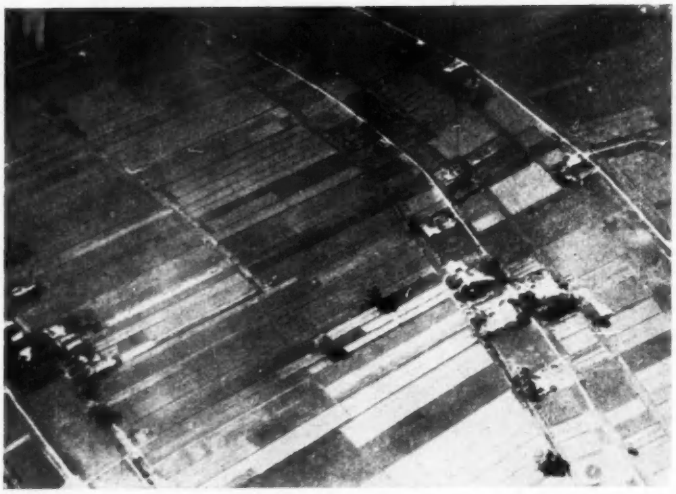

FIG. 19.—Fields in the Yangtze Delta (taken from an airplane). Rice, the most important crop, is gathered in the late Autumn. Cotton is gathered on ground too dry for rice. They are followed by broad beans, winter wheat, market vegetables and the like. Rape comes in spring, as well as mulberry leaves for silkworms.

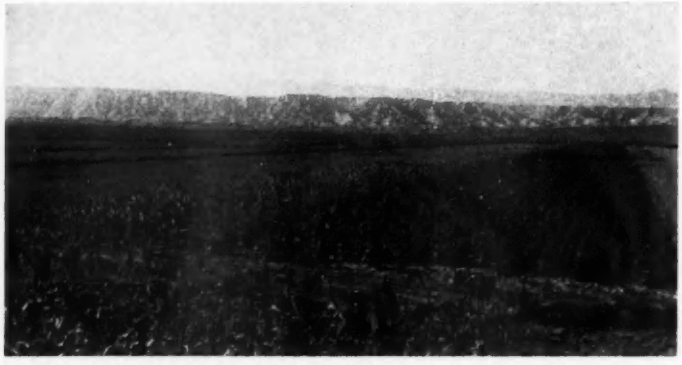

FIG. 20.—Cotton fields on the southern bank of the Hwang Ho, in Linpao Huen, western Honan Province.

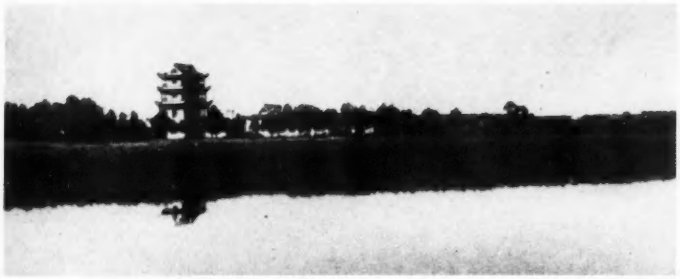

FIG. 21.—Rice fields in the Ningsia Plain, where canals total 500 miles in length, bringing an area of 125,000 acres into irrigation.

FIG. 22.—Areas subject to frequent floods.

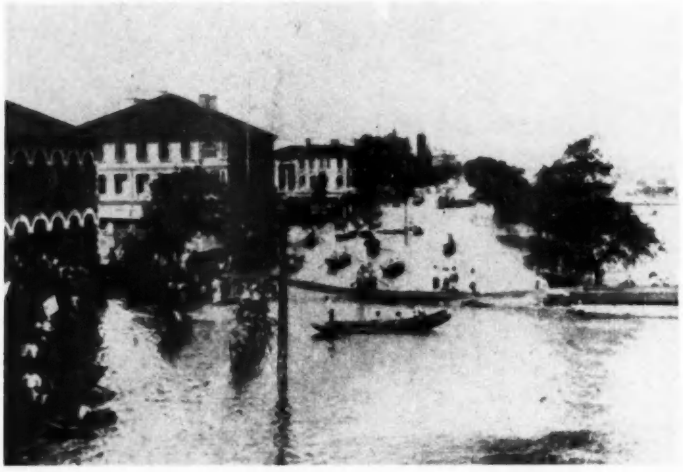

FIG. 23.—Main street of Hankow, showing the boat traffic and flood waters, summer, 1931.

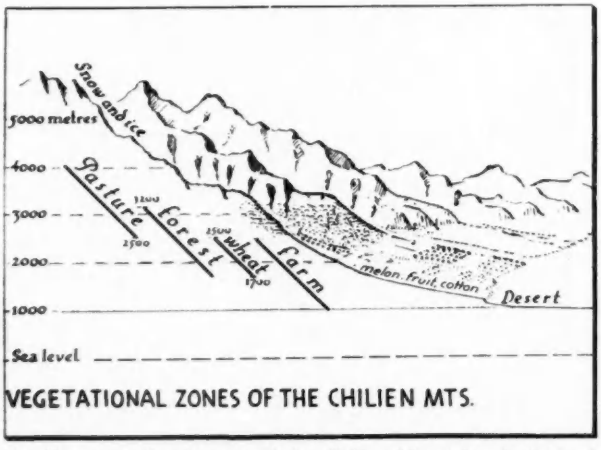

FIG. 24.—The vegetational zones of the Chilien Mountains (redrawn by Erwin Raisz).

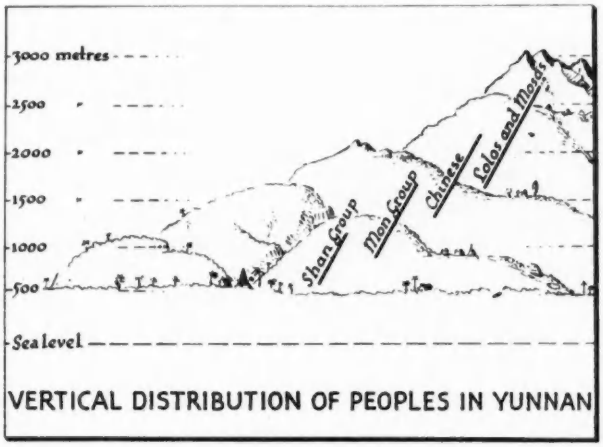

FIG. 25.—The vertical distribution of peoples in Yunnan Provinces (redrawn by Erwin Raisz).

A Note by the President:

The Association has moved toward renewed and enlarged international contacts. A session at the Knoxville meeting was given to first-hand reports on geographers and geography in England, France, and Germany, by American geographers recently returned from the European theater.[1] Three Chinese geographers attended the meeting and one of them presented a paper on China.[2] From the Americas, six Brazilian geographers of the Conselho Nacional de Geografia, working at present in the United States, attended the meeting[3]; and three Canadian geographers presented papers on Canada.[4]

A month before the meeting, officers of the Association felt that contacts with Russian geographers should be established without delay. Accordingly a cable was sent to the Soviet Geographical Institute at Moscow inviting a Russian geographer to attend the meeting at Knoxville and offering to arrange for his trip and expenses while in the United States. The Division of Cultural Relations of the State Department and American Overseas Airlines were ready to cooperate.

Due to the shortness of time and other circumstances the proposed visit had to be postponed until a later meeting. But the following radiogram to the President of the Association was received from the delegate elect. "Please accept my warm gratitude for your invitation to attend the meeting of the Association of American Geographers. I have mailed my report, 'Theory of Physical Geographic Process,' addressed to the meeting at Knoxville. Ill health prevents me from attending personally. Please convey to the meeting of the Association of American Geographers sincere greetings from Soviet Geographers and wishes for the success of its work. Signed A. A. Grigoryev, Member, Academy of Sciences of the U.S.S.R., Director, Institute of Geography."

Robert S. Platt

(The summary paper was transmitted through the Society for Cultural Relations and sent by cable from Moscow to Knoxville. It is printed herewith as an invited paper by authorization of the Council of the Association. *Editor.*)

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[1] L. S. Wilson on England, F. W. Foster on France, T. R. Smith and L. D. Black on Germany.

[2] Huan-Yong Hu, of National Central University, on the Population Density of China; Chun-fen Lee of Chekiang University; and D. K. Loa of the Geographic Institute of China.

[3] Jorge Zarur, Assistant Director, Serviço de Geografia e Cartografia; José Verissimo da Costa Pereira, Fábio de Macedo Soares Guimarães, Lindalvo Bezerra dos Santos, Lúcio de Castro Soares, and Orlando Valverde.

[4] Benoit Brouillette, Ecole des Hautes Etudes Commerciales de Montreal, on an Atlas of Canada; D. F. Putnam, University of Toronto, on Old Ontario; and J. W. Watson, McMaster University, on Niagara Settlements.

Theory of Physical-Geographic Processes

A. A. GRIGORYEV

The determination of interaction between components of the geographic medium has represented a fundamental theoretical problem of geography for some time. But little has been done in this respect, partly because the "chorological" and "comparative" methods, which have dominated in geography until now, are insufficient for this purpose. Therefore, it is necessary to make equal use of another method, that of investigating the processes by which the geographic medium is formed: namely, the "Physical-Geographic" or "Physiogeographic" processes.

The physiogeographic process of forming a natural medium represents a complex process in nature consisting of a number of components and involving interaction as well as interconnection between all the natural components of the medium, thus determining: (1) peculiarities of separate territorial units of different orders in the physiogeographic medium; (2) the character of their internal development; (3) peculiarities of the external form of the earth's surface, not including changes due to the activity of human society.

By the geographic processes we understand the heterogeneous complex sociogeographic processes developing in a given area and interacting wisely with the physiogeographic process inherent in that particular area. By the term sociogeographic processes we understand a wide range of complex and mutually related processes, including the economical mastery of resources and the realization of potentialities of territorial arrangements of the processes of production, distribution and associated activities.

This process is expressed in the cultural landscape and in many features of human life observed in the sequence of their development. The internal development of this complicated process serves as the fundamental motive power in the development of human society proceeding in accordance with geographic conditions, as a confirmation of nature.

Accordingly we have studied a number of cases as examples of physiogeographic process. Considering them as superficial evidences of the earth's geological past we find these principal stages:

(1) a stage of preworld existence;
(2) a stage of active development of land and water;
(3) a stage of active interference by human society.

Considering the physiogeographic processes for comparatively short intervals of time we must distinguish the stage of development of each emerg-

ing type of physiobiographic process and the stage of development of the physical type of process already fully formed. On account of the great complexity of the physiogeographic process it is necessary to break it down into component partial processes to be investigated as parts interacting separately in relation to the whole.

These parts are not singled out arbitrarily. In each of them there are inherent laws appropriate to its development. They may be single components (for example, climatic, hydrological, geomorphological, phytogeographic, zoogeographic) or complex components (for example, hydro-geomorphological, biogeographical, etc.).

To understand systematically the structure of such a component and its rôle in the whole physiogeographic process it is necessary to discover which elements of the given component are the principal motive powers of its development. One of the most important problems accompanying the study of the physiogeographic process as a whole is to discover what component or combination of components has been dominant in the period of the earth's geological history which is characterized by a physiogeographic process more or less analogous to the contemporary one.

This is mostly a combination of climatic and geomorphological components which have acted on the land as a fundamental motive power in the development of the physiogeographic process. Most of these phenomena are observed as well at present as at other times. Interrelations between the geomorphological and climatic components as motive power in the development of the physiogeographic process for a limited period depends to a considerable extent on the territorial extent of that process.

Analysis of these changes allows for the establishment of the following gradations in the physiogeographic subdivision of land areas:

(1) the lands of the earth as a whole,
(2) geographical belts,
(3) meridianal sectors,
(4) latitudinal zones and subzones within sectors,
(5) geographic provinces and subprovinces within zones or subzones,
(6) transverse belts within provinces or subprovinces (pertaining to mountainous regions only).

Transverse belts in the mountains and subprovinces in the plains are divided into geographic districts or landscapes.

The fundamental motive power of the physiogeographic process in most cases is a combination of hydro-geomorphological and phytogeographic components. With respect to the geomorphological component of the phyto-

geographic process in the higher gradations of land division, if the tectomorphogenetic component at great depths in the lithosphere is more important than the hydro-geomorphological component in the landscape, then the more important part of this component is the exogenetic part developing with respect to the surface of the lithosphere and interacting with superficial factors. A great span of geologic time is necessary in connection with the phenomena at great depths, whereas the surface phenomena and all other components of physiogeographic process act comparatively quickly.

Thus we can divide physiogeographic process into two kinds: an inner process proceeding at great depths through the lithosphere, and any surface process. Studying physiogeographic process for comparatively short periods we may confine our investigation to any surface physiogeographic process.

With respect to the climatic component the magnitude of the thermoenergetic basis and its correlation with the amount of atmospheric precipitation play a most important part. The maximum intensity of the physiogeographic process on a given thermoenergetic basis takes place only if the amount of atmospheric precipitation somewhat exceeds the amount of evaporation, corresponding to a thermal condition which provides a small but more or less regular runoff. Under these conditions different components in the process develop regularly and not in opposition to each other. A surplus as well as a lack of atmospheric precipitation, above or below the optimum, causes a decrease in the intensity of the whole process and disturbs the regular development of the separate components. In this case even the direction of development may change.

At the optimum amount of precipitation the intensity of the physiogeographic process increases with the rise of the thermal basis. The amount of moisture released in the physiogeographic process depends upon vertical components of air and movements throughout the lower layers of the troposphere (caused by the local and general circulation of the atmosphere) plus the moisture content of the air, a greater amount of evaporation, and greater geologic-orographic variations.

All these conditions determine correlations between heat and humidity, and consequently also intensity of the physiogeographic process during each stage of the annual seasonal cycle, each stage having the definite type structure of a partial climatic process.

At these stages changes of the moisture and heat of the soil layer following the preceding seasonal stage may have a considerable influence on the intensity of the physiogeographic process. From this thesis we have deduced "the law of intensity of physiogeographic process," formulating it as follows.

"The intensity of surface-physical-geographic process in each seasonal or subseasonal stage in a yearly cycle is limited to the paramount inherent heat energy and within this limit commonly varies: (1) in accordance with the amount of atmospheric precipitation as it approaches optimum value, where the amount of precipitation exceeds somewhat the amount of evaporation corresponding to the local thermal conditions, taking into account air currents, humidity, and loss of water, and the increase of runoff due to geologic-orographic conditions; and (2) in accordance with the structure connected with it, the order of intensity of physiogeographic process preceding the seasonal or subseasonal stage. In summary the intensity of this process for the year is determined by the intensity, relative duration, and inter-action of its seasonal and subseasonal stages."

This law deals with only one aspect, though a very important aspect, of physical-geographic process. In this discussion other laws have become evident, but to dwell upon them now is not within the scope of this paper.

Titles and Abstracts of Papers, Knoxville, Tennessee, December, 1945

ROBERT S. PLATT.

Problems of Our Time.

(Presidental address, published in full in this issue of the *Annals.*)

WALLACE W. ATWOOD, JR.

Topographic Models in World War II.

Topographic models saw distinguished service in World War II. They were prepared in portable laboratories behind the front lines; on the decks of warships; in secret underground shops and in permanent model laboratories located in Washington, London, Pearl Harbor and elsewhere. The many thousands of models produced were used by all branches of the armed services. They were used by the Chief of Staff for determination of operational plans, the Admiral of the Fleet for outlining naval operations, airborne troops, radar navigators, weather forecasters, pilots, secret agents, amphibious landing parties and many others.

The construction of models for use by our fighting men is a serious job. Errors in the interpretation of terrain or location of strategic information may result in tragedy. The necessity for accuracy in model work was recognized by the Office of Strategic Services when in 1943 they established a Topographic Model Section and insisted that it be manned by a staff of professional geographers. At the peak of production in the spring of 1945 the Section included 14 Terrain Specialists, 4 Map & Photo Researchers, 4 Artists, 4 Cartographers, and 4 Terrain Technicians. This group produced models of every active theatre of war.

The operations involved in the construction of accurate topographic models are as follows:

I. *Research and compilation.* This involves: (a) the location and acquisition of the best available maps, aerial photographs, geological surveys, terrain studies, and intelligence reports; (b) the evaluation of this material by a staff of persons thoroughly trained in physiography and map interpretation; and (c) the construction of contour, hydrography and culture plates.

II. *Terrain base construction.* This operation consists of cutting and casting the contour-step-model or the transfer of topographic and hydrographic information to the modeling block.

III. *Terrain modeling.* Modeling of terrain in plastolene or carving

same in plaster using large-scale maps and aerial photographs for topographic information not shown on terrain base.

IV. *Construction of mold.* Master mold is prepared in plaster and then checked under reverse slide projection for last minute changes in topography.

V. *Construction of final cast.* Final cast is prepared in plaster, rubber or metal depending on proposed use for the model.

VI. *Painting and lettering.* This includes shadow painting of terrain, addition of hydrography and culture, and lettering names of cities, airfields, radio stations, water bodies and strategic installations. Information is located on the model by orthographic projection from original compilation plates.

JAMES R. BECK. (Introduced by Hallock F. Raup.)

A Map of Ohio Trade Centers in 1939.

Retail trade in Ohio in 1939 engaged one-seventh of all persons over 14 years old who were gainfully employed at work other than public emergency relief. Data from census sources is employed to obtain four quantitative aspects of trade-center functions. These are shown on a single map for each of 177 cities, having 2,500 or more inhabitants. These cities make 87.2 per cent of Ohio's retail sales. The remaining 12.8 per cent of the sales are relatively uniformly distributed among Ohio's counties. The dollar value of sales is shown for each trade center as a cube with a volume proportionate to sales. Three indexes are placed on the faces of these cubes to show (1) the part played by retail trade in the support of the local community (Formula: *Persons engaged in retail trade ÷ employed persons over 14 years old in all occupations other than public emergency relief × 100 = Index in per cent*), (2) the service rendered to persons not living in the community (Formula: *Total sales in dollars ÷ local population = Index in dollars*), and (3) the composition of trade (Formula: *Total non-food sales ÷ food sales* = Ratio index. Specific features shown by the four quantitative indexes at individual centers and in associations of cities are examined to illustrate the value of the map. The map may be used either to evaluate the combination of characteristics present at an individual city, or to locate any trade center with respect to other trade centers for which similar quantitative data is shown. The map has utility for geographers interested in the trade center function of cities either in mass, or as a part of chorographic study.

NELS A. BENGTSON.

Objectives and Course Offerings in College Geography.

Geography has now attained a position of recognized intellectual re-

spectability in the majority of the so-called ranking colleges and universities of the U.S.A. This position carries with it the responsibility of leadership in creating a pattern of course work that can be announced as the consensus of the senior geographers of this country. To meet this responsibility, Professor Whittlesey, President of the A.A.G. in 1944, invited the writer to serve as chairman of a sub-committee to investigate the problem and the prevailing course practices in order to prepare a statement to be presented for discussion.

Three lines of investigation have been carried out, namely, (1) statements have been prepared by five colleagues on the committee, (2) the courses in geography now being given, if any, in each of the 46 colleges of the eight states briefly described, and (3) the title and general nature of the introductory courses in geography listed in the catalog statements of 20 of the larger colleges and universities of the U.S.A. have been summarized.

The specific objective suggested as the chief aim of the committee's work was "to present a statement of the aspects of human geography, preferably to be treated by departments consisting of one man, two men, and a full complement." In this progress report the introductory courses only are summarized. It is our belief that an overview of courses now being given in the one-man departments as well as those presented in fully staffed departments will prove to be of interest. Geography is offered in 36 of the 46 colleges and universities of the 8-state Missouri Valley area. Principles of geography, broadly construed to include such titles as elements, general, human geography, and introduction to geography, is the ranking first course now being presented. Human geography was reported by title in but four of the colleges, and world geography in but two. Economic geography without any other geography as a prerequisite ranks second.

In the 20 so-called class-A institutions whose introductory offerings were listed, the first or introductory course was reported broadly as general geography or elements in ten, economic geography without any prerequisites in eight, regional world geography in six, and physical geography in three of the universities. The trend seems to favor the presentation of two parallel introductory courses, one that emphasizes the distribution of population and the activities of man in relation to natural environment, the other places emphasis upon the distribution of natural resources, including agricultural possibilities, in relation to man's productive pursuits.

The divergent points of view of members of the sub-committee and their relationships to apparent trends and the prevailing practices in presentation of college geography are treated in résumé fashion by the writer as chairman of the sub-committee designated above.

LLOYD D. BLACK. (Introduced by Chauncy D. Harris.)

Preliminary Report on German Geography, 1939–1945. Part II. Present Status of German Geography.

German geographers are organizing in a struggle for professional existence. Unsettled conditions at the time of surrender found many geographers prisoners of war or homeless. Some had lost their jobs through the destruction of property and others through the break-up of war and civil agencies such as Mil-Geo, Mar-Geo, the Forschungsstaffel, the Foreign Office and the Reichsamt für Landesaufnahme. (*See abstract of paper by Thomas R. Smith, below.*)

By the end of the summer (1945), employment of geographers in private firms, civil agencies and educational institutions had begun. The model-making firm of Karl Wenschow in Munich employed Dr. Kolb, formerly in Mar-Geo. Bibliographisches Institut resumed cartographic work under Edgar Lehmann. Justus Perthes was operating in Gotha, but was later reported to have been moved by the Russians, presumably to Kiev. Emil Meynen hired Gottfried Pfeifer to assist him in the development of a new program for the section on Landeskunde of the Reichsamt für Landesaufnahme. Professor Troll was recalled to Bonn and Professor Schmieder to Kiel. Professor Behrmann was appointed professor at Berlin.

Plans are under way for a zonal organization of geographers. Credner, Troll, Meynen, and Pfeifer are the most active promoters. Behrmann and Lautensach are to be the leaders in the Rusian zone, Troll and Schmieder in the British zone and Metz in the French. For the American zone plans are much more elaborate. Credner has proposed the establishment of four centers: Munich, Scheinfeld, Weilburg and Heidelberg, and has outlined a general research program. The Abteilung für Landeskunde (Scheinfeld) would coordinate all geographic research in Germany.

Despite many difficulties, the German geographers are striving industriously to improve their destiny.

S. W. BOGGS.

Inventory: The Earth And Its Tenants.

If the earth were as large as Jupiter, with a surface area 120 times that of our own planet, it would be much more difficult to think and plan in global dimensions, even in these days of radio and airplanes. But as it is so small it behooves us to think in planetary terms. We should therefore take stock of our resources and facilities, and should consider the human tenants of the earth and their propensities and capacities. We should try to observe and report as objectively as would a delegation from a distant planet—while recognizing that it is impossible to do so.

Taking inventory of the earth and its resources, the patterns of distribution of land and sea, of mountain and plain, of climatic and vegetation zones, of mineral occurrence and availability, are extraordinarily uneven. We can estimate their adequacy to meet food, shelter and clothing requirements, and to satisfy esthetic desires. Such factual stock-taking, though quite incomplete, is on the whole reassuring.

When we regard man in his environment and in relation to his fellow men we find much greater uncertainties. Sometimes, instead of recording facts we can only list a series of questions.

Societies limited in range of activity for thousands of years have evolved localized cultural patterns of great variety. Each group had to be self-sufficient or perish, and each developed notions of its own superiority. Invisible but real barriers have been erected at many frontiers.

The scientific method, recently developed and relentlessly applied, has brought a technological revolution that has transformed human relationships the world over. Cultural indigestion has ensued. How can cultural collapse be avoided, especially in those societies that cherish ideas of material progress? Scientific techniques could presumably aid in achieving social evolution, but will they be given an opportunity? Can men who know no loyalty lesser than that to all mankind cure a world of men who are suffering from cultural myopias?

CLYDE J. BOLLINGER.

A Multi-Synoptic Map of Population Change in the South, 1920–1930–1940.

The progress of geographical science is, in no small degree, dependent upon the extent to which it is found possible to employ statistical techniques in the analysis and solution of problems. Geographical problems, however, are somewhat unique statistically in that they involve the correlative association of related variables in space. As a result, most geographical problems are not readily attacked by conventional statistical methods, and additional techniques are needed.

Multi-synoptic mapping may be defined as a method of geographical analysis and cartographic representation whereby the areal association of two or more landscape variables are so represented as to permit recognition and vizualization of the areas of like deviation or changes of the variables on a single map. This is accomplished by defining a series of correlative types representing all possible sign combinations of the associated landscape variables under eximation. A series of map colors are assigned to the various types according to which the unit statistical areas are classified and represented on the map. The resulting map depicts the areas in which there is

homogeneity with respect to the sign association of the variables and from which the distribution of the deviation or change-patterns of each of the included variables may, through reference to the map key, be deduced, thus making possible comparative map study without the necessity of diverting attention to a second map.

The number of correlative combinations that are possible depends upon the number of variables involved. With two variables there are four, with three variables there are eight. This method is applicable to the study of all classes of associated landscape phenomena for which numerical data are available. However, three types of correlation problems arise: (1) The correlative deviations of two or more associated variables in the same landscape, (2) the correlation of trends of two or more associated variables in the same intercensus period, and (3) the correlation of variations in a single category of phenomena in different periods.

A map of population change in the South, 1920–1930–1940, is presented to illustrate one of the two types of geographical analyses for which the Multi-synoptic Method is useful. The map, in four colors, defines areas of positive correlation, designated respectively: persistent increase and persistent decrease. The areas of negative correlation are designated respectively, recovery and recession. The rates of change in each county are indicated by symbols.

BENOIT BROUILLETTE.

An Atlas of Canada Project.

It has long been felt that Canada should have a new edition of its national atlas. Modern atlases are of two types: dictionary and geographic. The purpose of the first type is to be useful and convenient to the public. It shows as many names as possible, and is informative. The other one is more scientific. Every map is carefully drawn by specialists who seek to make the geographic phenomena understood: land forms, climate, population, resources, etc. The best example is the Atlas de France (1933–1944). Such atlases involve a great amount of research work.

In the second part of our inquiry, we have listed all maps available in Canada, or at least their sources. They are to be found in Ottawa (12 different services) and in every provincial capital.

CHARLES C. COLBY.

Regional Migration of Shipping Leadership.

Leadership in shipping was regionally localized in antiquity, and although it has migrated from region to region, it has continued to be highly localized. The Eastern Mediterranean pioneered shipping activities and

from this cradle area the Phoenicians and the Ancient Greeks served the early maritime world. Rome, in its time, commanded the sea lanes although the Romans were not a sea-going people. Through the dark ages the Byzantians from their strategic site kept alive the arts and practices of the sea. The Ancient Scandinavians brought leadership to the North and sailed far beyond their native waters. Later the Western Mediterranean and the Baltic became the major commercial areas. Taken together they prepared the way for the great adventures of the Spanish and the Portuguese on the high seas. For the first time, the oceans rather than the enclosed seas became the maritime arenas. Control, however, was exercised from Iberia. The wealth gained by the Spanish and Portuguese influenced the course of Europe for an eventful century and in time invited energetic competitors on the ocean routes. Then slowly but surely leadership in maritime affairs migrated to the lands bordering the "Narrow Seas." From this area there developed a far-flung organization of shipping and trade which in recent times has given global dimensions to the world's economy.

JOHN W. COULTER.

Post-War Human Geography of South Sea Islands.

The second world war has changed tremendously the pre-war human geography of South Sea islands. Polynesians, Melanesians and Micronesians all have suffered severely from the effects of the global conflict. Landscapes have been transformed. Great wharves, piers and moles project into sequestered bays where only outrigger canoes were known before. Barracks and supply depots have supplanted grass huts. Coconut groves are in shreds, torn apart by airplane bombs and artillery fire. Large areas formerly used for coconut and banana plantations are now airplane fields. On great tracts of former wasteland rice, asparagus, cabbage, potatoes and other crops are raised—a use of the land which was never practised by South Sea people.

Great changes have taken place in the economic life of the native people. Hundreds have worked as laborers raising the new crops and, for the first time in their lives, have been paid wages. Thousands have worked as stevedores at ports, and in transportation gangs carrying supplies and military equipment across country. Women in the South Seas have received what to them are fabulous prices for washing soldiers' clothes. Several thousand natives were inducted into the armed forces and served on patrols, as scouts and manning coast artillery. Hawaiians served with the Army of the United States in Hawaii, on the mainland of America and on both Pacific and European battle fronts. Medals for distinguished service have been awarded. Natives of the South Seas who have gone abroad as soldiers will

find when they return fruitful fields in which to promulgate new ideas of ways of living, for they will find the outlook of their kinsfolk at home also much altered.

The psychological and cultural changes wrought by the war have been the most severe. The second world war disintegrated much that remained of native life and culture. The urge to return to the old way of living in their villages is met by the counter-urge to work away from home. This has resulted in an unstable condition of native society.

The political status of island groups has assumed new aspects. The Dumbarton Oaks Conference in Washington and the United Nations Conference for International Organization in San Francisco have aroused hopes in the minds of South Sea people for more self-government in the world of tomorrow. The situation in Pacific Islands resulting from all these factors has made the problem of the government of dependent territories more difficult to solve.

NELSON H. DARTON.

Crater Mound, Arizona.

I am asked why I do not use the name Meteor Crater or Meteor Mountain for the wonderful rock outburst about 20 miles west of Winslow, Arizona, on my Geologic and Topographic Maps of Arizona, Santa Fe Railroad Guide Book (U.S.G.S. Bull. 613) and Résumé of Arizona Geology, recently reprinted. The reply is that the name Crater Mound was established by official action by the U. S. Board of Geographic Names in 1913 and is still in force. The feature is not a mountain but a low ridge of ejected fragments encircling a great crater, very nearly a mile in diameter and 600 feet deep. The application of the word "Meteor," is unjustified because the existence of a meteorite underground has not been established by concrete proof. It is reported that one and a half million dollars have been expended in shafting, drilling and geophysical surveying without finding the supposed meteorite.

I advise persons interested in such craters, to visit Zuni Salt Lake in western New Mexico, 120 miles east of Crater Mound. It has a low encircling ridge of distinctive fragments ejected from far below the surface, as at Crater Mound, but it contains near its center a recent volcanic cinder cone, a proof of vulcanism. The similarities of the two craters were shown in my article on "Explosion Craters" in *The Scientific Monthly* in 1916.

LOYAL DURAND, JR.

The Cheese Region of Northwestern Illinois.

The intensive dairy regions of Illinois are primarily two in number, the

northeastern portion of the state (an area extending from the latitude of Chicago north and northwest in triangular shape to the Wisconsin state line) and the northwestern portion of the state, primarily in Stephenson and Jo Daviess counties abutting the Wisconsin border. Each of these regions, viewed on a national scale, is an "overflow" from the main dairy region northward in Wisconsin. The dairy region of northeastern Illinois is primarily a producer of fluid milk for the Chicago market, while the dairy region of northwestern Illinois is a manufactural region, a part of the western manufactural portion of the main American Dairy Region west of Lake Michigan.

The milk from the farms of the dairy region of northwestern Illinois is sold to crossroads cheese factories, and to creameries, primarily the former. In this respect the region follows a pattern of dairy manufacturing common to the areas north of it in Wisconsin. Crossroads cheese factories and urban cheese processing plants are features of the local landscape, and the products which emanate from these manufacturing plants are important enough in quantity to place Illinois in second position nationally to Wisconsin in cheese production. Thus, while *statistically* the state of Illinois occupies second place in cheese production, *regionally* the production is part of that from the large national cheese manufacturing region centering in Wisconsin. The state line serves merely to segment the area into a large northern region in Wisconsin and a small southern one in the extreme corner of Illinois. Illinois, among the states, is third in total number of cheese factories (Wisconsin, New York, Illinois), second in production of Swiss cheese, second in production of American cheese, and second in production of brick cheese.

The Cheese Region of Northwestern Illinois is located in the very southern portion of the Driftless Area, and in a somewhat similar maturely dissected region thinly mantled with old drift of Illinoian age whose present land forms are due primarily to stream erosion rather than to glaciation. Climatically the region is on the Dfa-Dfb border. On its southern edge it merges into the Corn Belt of the Illinois prairies, and dairy farms are replaced by beef cattle or corn-hog farms; dairying increases in intensity northward across the region toward the Wisconsin border. The manufacture of Swiss cheese is highly concentrated in northern Stephenson County, adjacent to the state line, and in juxtaposition to the Wisconsin manufacturing area.

Since all warehouses and wholesaling facilities for Swiss cheese are in Wisconsin, the product of the Swiss factories moves northward across the line. The manufacture of American cheese is more widely scattered throughout the region. Warehouses and processing plants for this variety of cheese are located within the area, as at Freeport, the master city.

The region, though small in area, is an intensive portion of the American Dairy Belt, of which it is a contiguous part. The presence of the Wisconsin-Illinois border on the region's north separates the region politically, but not geographically, from the leading Swiss cheese district of the United States.

ADA ESPENSHADE. (Introduced by W. Van Royen.)

Political-Economic Aspects of the Expansion of Japanese Fishing in the North Pacific.

In connection with its fishing operations in the North Pacific Japan encountered controversies with other nations. Of these, three were of major proportions: (1) the Russo-Japanese controversy; (2) the Japanese-American salmon controversy; and (3) the Japanese abrogation of the Fur Seal Convention. Each of these will require reexamination and settlement.

The Japanese have come to look upon "the northern fishery" in its entirety as their own, although the most productive part is in Soviet waters. The Treaty of 1907 recognized their right to fish along the Russian coasts and provided for the establishment of fishing "lots" for which Japanese could bid on an equal footing with Rusians. Japan has consistently tried to maintain and enlarge its foothold in this fishery and in most years held the largest share of the lots. Since 1936, however, the Soviet Union has attempted to repudiate the obnoxious arrangements which grant the use of an important part of its fishery resources to another nation.

One phase of Japan's intensive prosecution of the world's fisheries was the "invasion" of the Alaskan salmon area. Largely dependent upon "the northern waters" for salmon, an important export product, Japanese expansion was limited in the Asiatic area by increased Soviet operations. Foreshadowed by scientific expeditions, in 1937 Japanese floating canneries, allegedly in Bristol Bay for crab fishing permitted by the United States since 1930, took large quantities of salmon. Although this clash with American interest and a government conservation program caused considerable discussion of the principles of international law as applied to fisheries, the fundamental issues were left unsettled.

By multilateral treaty the United States, Great Britain, Russia, and Japan agreed in 1911 to protect the North Pacific fur seals which establish summer rookeries on American, Rusian and Japanese islands but migrate southward in winter. As a measure to rehabilitate the stock, pelagic fishing was prohibited north of the thirtieth parallel. In 1939 Japan abrogated this treaty, claiming that the increased herd was deterimental to its fishing industry and indicating that its share of the catch was inadequate.

Japan, with an exceptionally high pressure of population upon its agricultural resources, may in the future find it imperative to rely increasingly

upon fishery products for food. Although most of the domestic supply is furnished by coastal and near-shore waters, resources of these waters are fully utilized. The North Pacific area, offering opportunities for increased Japanese exploitation, may again become the seat of international friction. To eliminate such disputes and to achieve and maintain the highest possible productive level, international regulation should be undertaken. Japan, as a nation sharing these resources, is a necessary participant.

FRED W. FOSTER.

Comments on French Cartographic Agencies During the War.

The purpose of this paper is the presentation of the condition of French map-making, map-collecting, and map-distributing agencies as they existed during and at the end of the war. Both governmental and private agencies are discussed. Problems of personnel and operation are considered together with prospects of future development.

OTIS W. FREEMAN.

Geography of Indiana State Parks.

The state park system of Indiana began in 1916 with the acquisition of the McCormick's Creek and Turkey Run areas. In 1945 there were 14 state parks and seven memorials, with a total of 37,410 acres. Most of this acreage has been donated to the state by individuals or as community projects. Other state parks are in process of being acquired.

During the past ten years over a half million paying visitors entered annually the eleven parks and two memorials that make an admission charge. The parks are intended primarily for the benefit of Indiana residents but have proved very popular to thousands of visitors from adjoining states. For example, while no breakdown of state and out-of-state visitors exists, it seems reasonable that Indiana State Dunes Park is used more by Chicago people than by Hoosiers.

The distribution of state parks is in part regional in order to provide recreation areas convenient to the population. However, efforts are made to include the most scenic areas available and samples of virgin timber. Incidentally, a fairly complete sequence of Indiana geological formations can be seen by simply visiting the state parks. The parks provide a wide variety of scenery and examples of many geologic processes. Several parks have hotel accomodations, which increases their usefulness to visitors. Brown County State Park is largest (15,128 acres), and a widely known artists' colony perpetuates on canvas the hill scenery of this region, especially when colored by the splendor of the autumn foilage. Although not included in the state park system, many state forests provide recreational opportunities,

and the State Highway Commission has built many overlooks from which far-reaching views are available. Some of the improvements were constructed by the Works Progress Administration in the nineteen-thirties. With only modest scenic resources, Indiana by its State Park System, has accomplished more for the entertainment of nature lovers and the recreation of residents and tourists than most other states.

LESLIE HEWES.

Landscapes of Northwestern Mexico.

Northwestern Mexico, whose most distinctive and largest part lies in the State of Sonora, is a region of considerable individuality. In its natural landscapes, it is not to be contrasted sharply with southern Arizona; but the Gulf of California to its west, the Sierra Madre to the east, and increasingly tropical conditions, differences in landforms and cultural history to the south, combine to set it off from other portions of Mexico.

The chief landforms are those of the Basin and Range, with interior drainage to the north and exterior drainage to the south of the Rio Sonora. The climate is dry and the vegetation is chiefly the xerophytic bush called *monte,* although scrub forest, oak, pine, and meadows occur with increasing altitude. Of especial human significance are the narrow floodplains cut into the basin fill, long irrigated from the villages on the terraces overlooking them, and the deltas recently developed for commercial agriculture.

Scattered Indian communities in the Sierra Madre, in part dependent on shifting hillside cultivation, Indian and mestizo communities in closely agglomerated villages and sprawling *rancherias* are enduring features of the human geography. Commonly, the agglomerated settlements show the results of Jesuit missionary activity, as in the field pattern, presence of old mission buildings, and the dominant position of wheat as crop and foodstuff. The hacienda, developed from early land grants, and devoted to both crop and animal production, is much less common than in the neighboring less arid and earlier exploited State of Sinaloa. The development of commercial agriculture by land companies through irrigation, now modified by the expropriation of land for *ejidos,* has occurred along both the lower Yaqui and Mayo rivers, in common with those to their south in Sinaloa. Mining activity, old and exhausted as at Alamos and Arispe, new and large as at Cananea, small and ephemeral in innumerble localities, has had a marked influence on Sonora. Today, the chief Spanish influences are to be seen in such mineral-related, decadent centers as Alamos and Aduana. Modern mechanized methods dependent on American capital and rail connections are exemplified by Cananea, which with other mining centers, normally constitutes a market for labor and surplus products from the villages.

The chief railroad, the *Sud-Pacifico de Méjico,* has been constructed so as to tap the new commercial irrigation districts in the deltas. Accordingly, it follows a course considerably westward from the old royal road, the *Camino Real,* which connected interior basin communities. Neither the modern nor the old regional and extra-regional transportation links have greatly impaired the localism and regional separateness of the Sonoran country.

HUAN-YONG HU. (Introduced by Derwent Whittlesey.)

Population Density of China.

China is the most populous country of the world. The total population of China, as published by the Ministry of Interior in 1938 was 459 millions. This represents the latest figure before the second world war. The following maps accompany the paper:

Figure 1 is a population map of Kiangning county which is situated outside of Nanking City. In this map the author used the population statistics for the smaller administrative units, which amount to 300 within the county area. A map like this shows better geographical details than one based solely on the county figures, since each county may comprise different natural environments.

Figure 2 is a population distribution map of China, on the scale of 1 to 20 million. Each dot represents 20 thousand persons. Figures 3 and 4 both show population density. The scale of Figure 3 is 1 to 12,500,000. The densities represented on it are correlated with the different natural environments without regard to the county boundaries.

Figure 4 is a map of southeastern China, scale 1 to 5 million. It gives only the average density of each county which is worked out by dividing the county population by the county area.

The highest density indicated in the two maps is that of more than 400 persons per sq. km. (1024 per sq. mile). The predominant quantity in this category is between 400–600 per sq. km. (1024–1536 per sq. mile). This is typical of the rice regions, such as the Lower Yangtze Plain, which is a rich alluvial plain almost without relief. The climate is hot in summer and mild in winter. The precipitation is about 40 inches (1,000 mm.). The irrigation system is highly developed. The dominant crops are rice in summer and wheat in winter.

In certain areas the highest densities may be above 1,000 per sq. km. (2564 per sq. mile), as in the Canton Delta. Here double cropping of rice each year makes possible such high densities. However, the number and size of high-density areas are limited in South China, as a large part of it is hilly.

In the North China Plain the average density is 300 per sq. km. (768 per sq. mile). This region looks rather like a mosaic on the second density map (Fig. 4), but on the first (Fig. 3) it looks more homogeneous. In North China the climate is cold and dry, and crops such as kaoliang, millet and corn are grown here instead of the paddy rice which is predominant in South China.

In Manchuria the density exceeds 100 per sq. km. (256 per sq. mile) only on the central plain. The other parts are hilly and consequently the population density is lower. In the whole Manchurian Plain the climate is very cold in winter. The farmers can only raise one single crop, such as kaoliang, millet or soya beans, in the summer season.

With the help of these maps we can understand well the different densities of the different regions. The Southern part of Kiangsu has the same area as Belgium but its population is twice as dense. China is still an agricultural country, though its population density greatly exceeds that of the industrialized countries. We believe that only by industrialization can we reduce the high pressure of rural overpopulation and raise the standard of living of the people at large. Industrialization is the sole solution for the teeming millions of Chinese.

GEORGE D. HUBBARD.

The Turning of Tirnovo.

Tirnovo has never been a large city but has been a capital of Bulgaria most of the time for 1,000 years. It became a religious center of the Orthodox Church in 1186 and has so continued to this day. It was a Roman fortified center before the third century, and the hills in the loops of River Yantra's entrenched meanders have repeatedly had their defenses strengthened until they were nearly impregnable in ancient warfare.

The Roman interest in the place witnesses to the commercial significance of Tirnovo. A north and south trade route led from Bucharest across the Danube at Ruschuk to the Aegean Sea, and an east and west route from Varna on the Black Sea west past Sofia, down the Diagonal Furrow to Nish and on to Belgrade and westward. Trade intersections are important points.

Constitutions and bills of rights have been written here; kings have been crowned, and then have built palaces and erected their churches here. Art, learning, splendor and pomp came to Tirnovo until it rivaled Constantinople.

Last century Sofia, closer to the west, became the capital even though the king was crowned in Tirnovo. The railroads came and the north-south line passed through Tirnovo, but the east-west line found easier crossings of the entrenched rivers a few miles north and intersected the Tirnovo N-S

line at a small town 7 miles down river, so the commercial importance was transferred thither. Only a patriarchate remains of all its former glories. A pretentious tourist house and Hotel Boris care for visitors who come in modern days to see the ruins of palaces, churches, fortresses, prisons, and ancient roads.

JOHN E. KESSELI.

A Neglected Field: Geomorphography.

Extensive use of geographic and geologic literature, foreign and domestic, for the purpose of becoming acquainted with the lay of the land of foreign countries, has revealed that good descriptions of relief and topography are very scarce. Some fifty years ago excellent terrain descriptions were still being written, both here and abroad. Since then the problem of origin of the land forms has received major stress in their descriptions, possibly following W. M. Davis' recommendation for explanatory descriptions. When such studies deal with larger areas they end more often in a description of diastrophism than in that of land forms. The latter are often left to the imagination of the reader. As land forms are an important part of the fundament of human geography, it is here suggested that geographers practice the art of geomorphography, that is, the art of terrain description, without too much concern for the origin of the land. For this purpose there should be developed an extensive descriptive nomenclature of small and large forms as well as of type areas. Numerous good descriptive names of forms, such as drumlin, caldera, inselberg, etc., or of type areas, such as ground moraine, karst, etc., are already in use. Their number need only be enlarged to make the process of terrain description an easy task and to assure a clear visualization of the lay of the land by the reader.

JOHN E. KESSELI.

Some Remarks Concerning the Mercator and the Secant Conic Projections.

Because the Mercator Projection shows regions in high latitudes greatly exaggerated in area as compared with equatorial regions, its use is commonly discouraged. It is, however, one of the three projections in which distortions at any point are the same in all directions. Since a linear scale for all latitudes is available in its margin or its grid, good approximations of distances can be made at any latitude in any direction, and areas can readily be computed approximately. The most highly recommended equal area projections do not permit this estimate of distances or area.

Conic projections with two standard parallels, such as the Albers Projection, De l' Isle's Projection, Lambert's Conformal Conic Projection, and

the Simple Conic Projection with two standard parallels, are frequently described as projections upon a secant cone. Diagrams showing the intersection of the cone with the sphere along the two standard parallels frequently accompany the descriptions. None of the grids of the above-named projections is based on the principle of the secant cone but on that of the tangent cone. The principle of the secant cone could be used in the construction of a Simple Conic Projection with two standard parallels in order to assure intersection of the meridians at one point. But in that case the standard parallels would have to be made shorter than they are on the sphere. The customary diagram of the secant cone would then fail to prove the maintenance of scale on the two standard parallels.

CLYDE F. KOHN.

Woodworking Industries and Settlement Patterns in Central Maine.

Woodworking industries based on local supplies of hardwood have affected settlement patterns in central Maine since the 1870's. These industries provided a temporary basis for new settlements in the towns of Willimantic and Lakeview. They became new foci for growth in the already established communities of Guilford, Foxcroft, Milo, and Brownville.

An abundant supply of paper birch attracted these industries to central Maine. Birch trees are found (1) scattered through the hardwood forested areas which were never farmed; (2) as a pioneer tree in the regrowth of forests on abandoned farm lands; and (3) as a dominant species in the regrowth of forests on burned-over lands.

The manufacturing of spools has been by far the most widespread of the various hardwood industries. Spool mills have at one time or other been located throughout the birch region of Maine, but the industry early became localized in the valleys of the Piscataquis and Penobscot Rivers. Large areas of land in these valleys were burned over by the Great Fire of 1825. Sixty years later, the birch which had reforested these burned-over areas, was ready to be cut. The settlement of Willimantic grew up around a mill established at the head of Sebec Lake. This settlement continued to grow until the turn of the century when decreasing supplies of birch caused the mill to be moved to Milo. The settlement was subsequently abandoned as a mill town and eventually became a fashionable recreational camp.

Lakeview at the southern end of Schoodic Lake experienced a similar development. Established later than Willimantic, this settlement continued to function as a mill town until 1927.

The spool mills established in Foxcroft and Milo have been more permanent. They were built adjacent to main railroad lines. When local supplies of hardwood declined, these mills imported lumber from other areas in Maine.

Two other types of hardwood mills furnish employment in the area. A pegwood factory built at Brownville in 1895 still operates and employs about a hundred men and women. A toothpick factory has been operated at Guilford since 1920. The birch for each of these mills is secured locally, much of it from farmers who cut it on old, abandoned farm lands.

Pure stands of birch trees are not a permanent type of forest in central Maine. After a time, they are replaced by a mixed hardwood forest. As birch disappears from the area, hardwood mill owners are faced with several alternatives: controlled burnings of large areas to supply a new crop of birch trees; the introduction of new products manufactured from hardwoods other than birch; and the development of plastics. Mill owners in Guilford, Foxcroft, and Milo are considering such possibilities in order to keep their plants operating.

EARL E. LACKEY. (Introduced by Leslie Hewes.)

Rainfall Probabilities in Nebraska.

The decrease in average rainfall in Nebraska from 33 inches in the southeast to 15 inches in the west renders critical the problem of agricultural adjustments. The critical nature of the situation probably is accentuated by the continued dependence of farmers and of students of agricultural methods and research on the mean as a measure of central tendency. The fact that meteorologists and climatologists find the mean a convenient or useful measure of rainfall does not justify complete reliance on it in the appraisal of Nebraska's hazardous agricultural situation. In areas where the rainfall differential is not so critical as it is in Nebraska, where the annual rainfall is more than 30 inches, or where the drought factor is not always imminent, the mean as a measure of central tendency of rainfall may not be so misleading. It seems that the beguiling nature of the *mean* becomes more and more insidious as the measured time interval is decreased from the year to the month and then to the week. For example, according to a 49-year record at Fairbury in eastern Nebraska, the mean rainfall for the 24th week of the year (June 11 to 17, inclusive) is 1.13 inches, whereas the median for the same week is only 0.66 of an inch. Both the mean and median are measures of central tendency, but the rainfall has been above the mean only 17 years out of the 49 (35 per cent)—misleading perhaps to one who is thinking of his chances in terms of years. At Lodgepole in western Nebraska for the same week the precipitation is less than half as much as at Fairbury, but conditions are more critical because the former station is well within the semiarid area. Since chance is such a large factor in farming operations in Nebraska, an understanding of the disparity between the mean and median should be given studied attention.

Six maps of the state showing this disparity during the past 49 years have been constructed by the investigator: two dealing with annual rainfall, two with June rainfall, and two with the 20th week of the year (June 11 to 17, inclusive). A bar diagram for Lincoln, Nebraska, shows these contrasts for each of the 26 weeks from April to September inclusive. The diagram also indicates the quartile deviations for Lincoln and the reliability of the median for each of these 26 weeks—two other useful measures of rainfall probability.

HOYT LEMONS AND MRS. ELIZABETH SCHICKELE.

Climatic Stress and Clothing Needs.

The correlating of human environmental and comfort needs with climate and portrayal of results on maps and charts will rank high among recent research developments. Initiated in the Quartermaster Corps by Paul Siple, it synthesizes elements of geography, climatology, physiology and physics.

Study of mutual heat transfer between the body and its surroundings and of relevant climatological factors are vital parts of the work. Rates of body heat loss by induction, radiation, and convection are calculated from temperature, vapor pressure, and wind velocity data; body heat load values derived from insolation are determined from the solar constant and atmospheric transmission coefficients. These methods make it possible to (1) map clothing needs for the body in thermal equilibrium, (2) determine and map tolerance time for the cooling body in a cold environment, and (3) map limits of activity in hot environments.

These studies used with new climatic maps (climatic zone series and temperature range series) make possible our military clothing program. Climatic zone maps are based on Thornthwaite's sliding scale of effective precipitation in which temperature and precipitation are correlated and climates classified as wet, humid, or dry. Zones of 10°C. are delimited for clothing needs and correlated with required clothing thicknesses. These maps are constructed for both monthly and annual periods. Annual maps portray monthly conditions for homogeneous regions by use of small circular graphs with 12 segments. The climatic zone system is also basic to further mapping of (1) required amounts of insulation and (2) tolerance times where insulation does not permit equilibrium between the body and its environs.

By combining the climatic zone maps of the coldest and warmest months for any region, a temperature range is established which readily translates into average clothing requirements for a year's span. Thus, the world has been classified into 22 regions, each characterized by a yearly climatic range requiring specified clothing amounts and types and/or bodily adjustments. Detailed mapping of the world on the temperature range system is underway.

The final maps are put on large scale physiographic diagrams, thus indicating in graphic manner the effect of topography on the yearly climatic variations. This general scheme places the determination of clothing needs on a highly objective basis, independent of the actual type of dress, and of individual variations in clothing use, which at times gives rise to contradictory claims on clothing needs.

As further climatological data are available, it is planned to map world clothing needs and bodily adjustment on the basis of the entire heat exchange between the body and its environment.

It is believed that important changes in civilian clothing will ultimately result from these researches.

A. K. Lobeck.

The Physiographic Provinces of Asia.

The subdividing of Asia into major and minor groups of Physiographic Provinces, on a geomorphic and geologic basis, is here attempted. Five major groups of provinces are represented, corresponding to similar groups in Europe (and in Africa), namely: 1. The Northern Shields; 2. The Northern Plains; 3. The Central Massives, and associated features; 4. The Alpine-Himalayan System; 5. The Southern Massives. A total of 255 provinces for all of Eurasia correspond with Fenneman's 85 subdivisions for the United States. Inasmuch as Asia is over six times as large, this indicates provinces averaging twice the area of those in the United States.

The main departure of this scheme from that shown on many tectonic maps of Asia is the restriction of the Alpine-Himalayan System to southern Asia and the inclusion of vast areas of central Asia in the group of Central Massives. This emphasizes the essential structure of the great ranges of central Asia which are broken remnants of extensively peneplaned areas developed upon complex structures produced during orographic movements long prior to those of the Himalayan System.

The Physiographic Diagram accompanying the province map, and prepared on the same scale, makes evident the main routes, corridors, gateways, and trenches of Asia which have from time immemorial been the highways of travel and commerce.

Harold H. McCarty.

The Theoretical Nature of Land-use Regions.

Geographers often experience difficulty explaining the concept of the land-use region to people unfamiliar with the field of geography. It appears, however, that sufficient work has been done to establish the theoretical nature of the land-use region as an abstract concept.

Two types of questions must normally be answered: (1) Why do regions appear, and (2) Why do they assume the characteristics normally ascribed to them? Geography has answered the first by pointing out that natural resources are spread unevenly over the face of the earth.

The second question is more difficult. It appears, however, to involve an explanation of two generally recognized characteristics which must be included in any conception of a theoretical land-use region. The analysis proceeds from the answer to our first question: The uneven distribution of resources. Griffith Taylor, Ellsworth Huntington and others have portrayed these variations graphically. Huntington's "climograph," in particular, shows how variations in temperature and precipitation produce areas of optimum and maximum production for various types of crops. Graphic presentation becomes more complicated, but it is quite possible to introduce other variables such as soils, surface features, or distance from market into this type of presentation. If the plane of the climograph (or its more complicated derivative) were the surface of the earth, it would show an area of optimum conditions surrounded by zones of lesser desirability, or, in terms of economics, increased cost, varying inversely with distance from the center. The outer margins of the region—the highest-cost zone to be occupied—would be determined by the prevailing price of the commodity. Zones of this same character exist around a cathedral, shrine, seat of government, marketing center, or other center of social attraction.

The analysis is not complete, however, until it introduces alternative types of land use and establishes the character of boundaries between the regions. This procedure involves the construction of additional graphs for other land uses and observation of the patterns of cost distribution which appear. Interstitial zones between the centers of optimum conditions for different land uses will often contain areas where costs for two or more types are identical. These "zones of indifference" which may occupy boundaries between regions are familiar to geographers. They are a natural complement to the previously quoted principle that land-use regions tend to consist of areas of intense development surrounded by areas or zones of lesser development whose intensity varies inversely with distance from the center.

SHANNON MCCUNE.

A Confucian World Map.

Korean scholars, trained in the Confucian classics, prepared a number of hand atlases in the 18th and 19th centuries. These atlases were designed for personal use in studying Korean and Chinese literature and for political administration. They contain maps of the World, China, Korea, the 8 provinces of Korea, and Japan. Each atlas is an individual copy. It has not

been possible to determine or date the prototype. Though following the same pattern, atlases vary with the skill of the cartographer both in format and calligraphy.

The most interesting map to American geographers is the world map. This shows China on the center of the world on a continent approximating Eurasia. This central land area is surrounded by an island-studded sea. Enclosing the sea is another land area, which in turn is surrounded by water. The areas near China are in close areal approximation and are correctly named. Further afield the place names are largely fanciful.

Of more interest than the cartographic aspects is the graphic illustration the world map affords of the Confucian idea of a world state. The concept, very briefly, is that the world is a unit. This world unit is centered around China, the middle Empire. The sovereign of China rules under the mandate of Heaven. He provides an example for his subjects. The people strive to live in correct relationships with each other and with nature. When man and nature are in accord, world peace and happiness result. Outside the Middle Empire are barbarians. These people when they are taught by example the principles of correct conduct, will then voluntarily submit themselves to the Sovereign power of China.

This concept of political life and international relations has not been sufficiently considered by American geographers. During the past two thousand years, the concept has had its periods of inattention, especially when the Middle Empire fell behind in technological knowledge. Generally, however, this concept has been the guiding political philosophy of the Far East. It has played and probably will play in the future a major rôle in the political geography of Eastern Asia.

ALFRED H. MEYER.

Areal Survey of the Realities and Potentialities of American College Geography.

World War II, like World War I, has revealed critical deficiencies in American geographic literacy. It would seem pertinent, therefore, at the conclusion of this war, to explore the status of college geography programs with a view of promoting first such standards of geographic instruction and research as will insure a sound professional development of our field and second its recognition by educators and administrators as a necessary part of an educational pattern designed to promote civic consciousness and responsibility in our democracy.

Accordingly, a partial survey of the college geography situation is presented and analyzed with the hope that the data may stimulate the geographer, the professional educator, and the college administrator to provide

organizational and functional facilities of geographic education comparable to those of other standardized college subjects. Our report is based upon questionnaire returns from 653 institutions distributed representatively among forty-eight states. Data received have been plotted on outline maps to show the state by state ratio distribution values of the several phenomena.

The various categories include the ratio of institutions in which geography 1) constitutes a separate department, 2) shares with another subject a departmental title, 3) is offered in non-geography departments, 4) is classified exclusively as a social science, a natural science, or as part of both.

A tabulation by states indicates the number of institutions offering a classified number of courses (including graduate courses).

A third feature concerns prospective innovations or changes in departmental organization, instruction, and research.

Some of the questions which a survey like this poses are: How can we account for the fact that some of our largest institutions of higher learning still get along without a geography department or without even any professionally trained geographers teaching such courses as are offered in geography? Are the departments in which geography is taught so organized administratively and functionally as to place the geographer on the same footing as other subject specialists? Is geography affiliated in whole or in part with the social science division where it can effectively develop, in conjunction and cooperation with the social sciences, it geo-social concepts?

Are our course offerings adapted to the new post-war era? Do they meet both subject and teaching minor and major requirements? Have we explored all the possibilities of extending our research facilities, including the staffing of our departments with specialists, both in the systematic and regional divisions of geography? And are we alert to the auspicious times in which we live in helping to "create" opportunities of placing our graduate as well as undergraduate students in positions where they can demonstrate the usefulness of geographic thinking in the educational and business world as well as in public life?

Partial answers to the questions are suggested.

HAROLD V. MILLER.

The Changing Geography of the Tennessee Valley.

The Tennessee Valley is heterogeneous in terms of physical makeup, kind and success of economic activities, and population distribution. It is an area which has undergone tremendous changes in the past decade. The greatest single factor in bringing about that change is TVA. This paper cites changes of interest to geographers.

The greatest physical change that has taken place is the creation of a

system of lakes which gives a percentage figure for water area half as high as that of Minnesota.

During the past decade land use practices have been drastically changed and soil erosion greatly reduced. Agricultural income has increased at a rate greater than that of the nation. Appliances, equipment, and better homes have followed the wider distribution of electricity.

Power production increased by 1,000 per cent during the past 12 years, and this was a major factor in industrial employment moving ahead of agricultural employment in Tennessee. About 400 new plants have been established, ranging from handicraft operations to atomic bombs. Reconversion prospects are excellent with few exceptions.

River traffic has become a reality with 208,000,000 ton-miles of waterborne freight in fiscal 1945. Interesting movements include midwest grain inbound, and local coal outbound, even to St. Paul.

War production, construction, and industrial experience have given the Valley a valuable body of skilled workers. Health conditions also are much improved, because of, among other things, better nutrition and reduction of malaria too 0.3 per cent of its former incidence.

With the increasing industrialization, raising of income levels, and more complete utilization of local resources, the valley is rapidly moving into an urban classification. Future population growth will be largely urban. With the increase in local economic opportunity, the valley should become less an exporter of population, and population should increase more rapidly than will that of the nation as a whole.

It behooves every geographer to acquaint himself with present-day conditions and prospects in the Tennessee Valley, rather than to depend on out-of-date or biased sources for information on this section of the country.

DONALD F. PUTNAM.

The Face of Old Ontario.

"Old Ontario" is the best known and most densely settled part of Canada, but its physical features continue to be inadequately described and mapped in geographical writings. This is not hard to understand, for our geologists have been so busy looking for mineral wealth in New Ontario, that they have had little time for a region whose wealth is in the less spectacular form of soils. Therefore, apart from the classic studies of A. P. Coleman, W. A. Johnson, J. W. Goldthwaite, and F. B. Taylor, Ontario, south of the Canadian Shield has remained practically unknown. During the past twelve years the writer, in company with L. J. Chapman of the Ontario Research Foundation, has been engaged in mapping the area, and the present account is a brief summary of that work.

The land forms of Southern Ontario are of two types; those which are the expression of the effects of erosion upon the bed rock, and those which are comprised of unconsolidated drift. In most cases, but not all, the latter are glacial in origin and, as yet, comparatively little affected by erosion.

Bed rock forms include the *rock-knobs* of the Shield and the slopes of the *escarpments* of the successive Paleozoic formations. The Niagara Escarpment is easily the most striking land form in the region, with a relief of about 1,000 feet overlooking Georgian Bay. The Onondaga Escarpment, on the other hand, is hardly visible. Extensive *rock plains,* chiefly on Ordovician limestones, lie along the borders of the Shield. Glacial formations are widespread, but particularly notable in south-central and southwestern Ontario. The well-developed terminal moraines in the "Horseshoe" about Taylor's "Ontario Island" are comprised of till ridges, kames and gravelly outwash. Even more striking are the many steep-sided valleys of the old melt-water streams. Till plains and drumlin fields, comprising fully one third of the area south of the Shield, are most extensive and important. Between six and seven thousand drumlins impart a characteristic form to the landscape of many districts.

Large areas are underlain by the lacustrine deposits of the Pleistocene forerunners of the Great Lakes. The clay plains between Lake Erie and Lake Huron and in the area south of Georgian Bay are important agricultural areas. The sand plains near Lake Erie have recently become important for tobacco growing. In Eastern Ontario there are also extensive clay and sand plains, but of marine origin, which comprise the chief farm lands. Abandoned shore-line features including terraces, wave-cut cliffs, beaches and bars mark the boundaries of the former water bodies.

The distribution of these features together with many of their local and special characteristics are shown in the accompanying maps, diagrams and photographs.

ERWIN RAISZ.

Landform, Landscape, Land-use and Land-type Maps.

The title of this article represents the four basic approaches to cartography.

The landform map is concerned with "physical" features such as mountains, plateaus, plains, shore lines, rivers, swamps, etc., and can be represented on large-scale maps with contour lines, and on small-scale maps with "landform" symbols.

The landscape map represents the visible pattern of the earth and is as close to a colored airplane photograph as the scale allows. In small-scale maps it uses symbols which in line and color resemble the actual feature on the earth.

The land-use approach will emphasize the human use and will show farming, manufacturing, mining, transportation, etc., using bold, distinctively-colored symbols.

The land-type map combines the three previous approaches. It will show relief by contours or symbols; it will select its colors and lines to resemble the visible pattern, but it will use the bold blacks, reds, purples to more or less overprint the map for land-use patterns. The coming of land-type maps as the universal method seems to be inevitable, as colored airplane photos are revealing to us the real pattern of the land.

VICTOR ROTERUS.

Future Industrial Land Requirements in the Cincinnati Area.

In planning for the future development of any urban area, it is necessary to estimate both the amount of land that should be set aside for various major land uses and the logical distribution of these land requirements within the area being planned. The manufacturing phases of this general land problem in the Cincinnati area are treated here.

The Cincinnati area is marked by flats and hills, characteristic of the Old Drift Flats region of Southern Ohio and Indiana. Transportation follows the basic frame of flats in the area, and this factor in combination with level land largely restricts industrial sites to these limited areas. These basic facts made it advisable to approach the problem, first, by mapping of suitable and available industrial sites in the area, and, second, by calculating theoretical future requirements which could be checked against the known facts of the landscape.

With reference to land available and suitable for industry, both occupied and unoccupied sites were surveyed in terms of 18 industrial areas representing present groupings of industry. There are some 1,384 occupied industrial sites in the Cincinnati area, using a total of 3,793 acres of land. The occupied sites range in size from $\frac{1}{8}$ of an acre or less to 674 acres, with the median site being less than $\frac{1}{4}$ of an acre. There are 5,354 acres of land suitable and available for future industrial development distributed among 176 potential industrial sites, ranging from $\frac{1}{2}$ to several hundred acres in size. In addition there are (a) 3,409 acres which need major conditioning to make them suitable for potential industrial use, (b) 824 acres of unused land on present sites of existing industries, and (c) an undetermined acreage on small sites of less than one-half acre.

The second major step in the approach was the theoretical determination of future land requirements for manufacturing which was considered from several points of view; (1) new requirements over the last 10-year period, (2) future requirements of existing and new establishments as indicated by

population and employment trends, (3) appropriate allowances for the additional land required by modernization of plant facilities and lay-out, and (4) requirements resulting from the displacements occasioned by proposed public improvement projects. In light of the facts emerging from these considerations, it was concluded that the additional land demands imposed by new and existing industries would not exceed 1,000 acres.

For several reasons, more land will have to be reserved for manufacturing than will ever be used. For example, to permit various concerns to find a site best suited to their particular operations and policies means reserving at all times a variety of site sizes in a variety of locations.

RICHARD J. RUSSELL.

Physical Characteristics of Loess.

The physical characteristics of loess are described and illustrated by Kodachrome slides from field exposures in the Lower Mississippi Valley.

THOMAS R. SMITH.

Geography and the German War Effort.

German geography during World War II has made significant and direct contributions to the Nazi war effort and developed symptoms of the authoritarian centralization which characterized most phases of German science. These developments are well illustrated by the work of geographers in three special military mapping and geographic research agencies attached to higher echelons of the Armed Forces. These were Section IV of the Abteilung für Kriegskarten und Vermessungswesen, under the General Staff of the Army, known as Mil. Geo., the Marine-Geographische Arbeitsgemeinschaft of the Naval High Command (Mar. Geo.); and the Forschungsstaffel zur besondere Verwendung attached to the General Staff of the Wehrmacht. In Mil. Geo. geographers formed a small minority in a large organization, but in the other two organizations they were in a more dominating position and, as a result, greater advances were made in geographic and cartographic techniques.

Mil. Geo. produced a huge quantity of geographic handbooks and maps covering areas of possible army operations in Europe, Asia and Africa.

Mar. Geo., under the direction of the Navy, was responsible for mapping coastal areas, chiefly for anti-invasion purposes. Considerable original work was done in the development of elaborate but readable classifications of strand surface, water depth and coastal landform to supplement the inadequacies of existing nautical charts and topographic maps.

The Forschungstaffel was primarily engaged in production of special terrain evaluation and passability maps for the Wehrmacht High Command.

Field teams were composed of integrated groups of earth scientists who worked closely together, using advanced methods of aerial observation, photogrammetry and ground reconnaissance in the rapid analysis and mapping of significant terrain conditions over relatively large areas.

Early in 1942 the Reichsforschungsrat, under the authority of Goering, began to integrate the research work of the remaining civilian geographers with the military programs of these and other agencies. Therefore the older and better known University men and Institutes became increasingly identified with military work. It is only surprising that this integration of the field of geography came so late.

FLOYD A. STILGENBAUER.

The Improved (Polar) Lobate Globoid Grid for a Polar Map of the World.

Through scientific and industrial achievements of World War II, man has come to think in terms of greater speed and shorter space-time. In view of the revolutionary changes that are taking place, there is need for new and better maps. The Polar Lobate Globoid Map of the World has a grid foundation which is strikingly globe-like, accurate for size, shape, and form of continents, without breaks in the land masses (antarctica excepted) and streamlined. The world grid is projected onto a lobated secant cone and thence to a disc-like plane at a determined distance above the North Pole and perpendicular to the axis of the earth extended. The world is viewed with the highest degree of accuracy from any direction by rotating the disc about the polar axis in the manner of a globe. A detailed step-by-step procedure for the construction of the Original and Improved Grids is given, showing computation table and drawings in the evolution of the grid. The final result is a rather symmetrical globe-like grid which looks exactly like a globe cut open into two lunar segments which are further split into segments that are swung outward into the polar horizontal disc. We then have a five-point grid with two lobes of 75 degrees, two lobes of 90 degrees each, and one lobe of 30 degrees, longitudinal extent. The Polar Lobate Globoid World Map has many advantages: it presents the greatest element of realism and as much or more of exactness as any map to come forth; there are no breaks in the land masses except in Anarctica; the continents are correct in shape and essentially equal area; the globe-like nature of the world in interrelation of parts is preserved; island groups are attached to continents where their geographic significance is greatest; hiatuses are so placed as to make them minimum inconvenience and least conspicuous; parallels dash-lined across the hiatuses bring out the projection aspects of flattened global segments; great circle routes can be measured and plotted

with a surprising degree of accuracy; the grid can be mounted on an axis at the North Pole and rotated as a disk in the manner of a globe; the map can be suspended from any side and the world perceived from different viewpoints.

HELEN M. STRONG.

Distribution of World Ocean Shipping.

The paper discusses: (1) number of ships and tonnage of each country, with statistical tables showing merchant fleets of the world and cargo carriers by vessels of nationals; (2) employment of ships of each national registry in the foreign trade of that country; (3) value of national seaborne foreign trade carried in national vessels of principal countries, with a statistical table showing estimates of value of total trade and of portion carried in national vessels, 1936; (4) revenues from shipping, with three tables showing gross and net earnings of principal merchant marines in comparison with national income and merchandise exports, 1936–1937.

GLENN T. TREWARTHA.

A Study of Farmsteads: Report of Progress.

This paper indicated substantial progress on a project analyzing the distinctive characteristics of farmsteads in a number of the specialized agricultural regions of the United States. A request was made for cooperation in the extension of the scope of this farmstead project and also in that of another study, on unincorporated hamlets, which was previously reported in these *Annals*, Vol. XXXIII, 1943, pp. 32–81.

STEPHEN S. VISHER.

A Projected Climatic Atlas of the United States.

The interest displayed by numerous readers of one or more of several articles containing more than 150 climatic maps of the United States, which have appeared in various journals in recent years, has encouraged preparation of an atlas including them and many others. At present, suggestions are sought on what form this atlas could best take and on what maps would be most widely useful. Help in locating valuable maps published in sources which may have been overlooked is also sought. All maps based on substantial data which would have considerable value should be considered before the final selection of maps is made.

J. W. WATSON. (Introduced by Donald F. Putnam.)

The Impact of the American Frontier on Niagara Settlements.

Few Canadian regions have seen more changes than the Niagara Frontier. A geographical gateway, it has become an historical divide. French

settlement and portage lay east of the frontier, British occupation transferred them west. Forts rose at ferry sites, connected by a new portage. The Loyalists used it to unite Upper Canada; Niagara was the capital, the frontier its thoroughfare.

In 1812 Canadians relied on the Dundas Road for defense, rather than the frontier. Frontier sites declined; interior sites expanded. The Welland Canal attracted settlements. St. Catherines and Hamilton rivalled Niagara.

Reciprocity and tariffs accentuated frontier rôles as trade channel and protection for industry. Railways made the frontier the link between Ontario and New York. Canada used it to exploit American outlets; America to contact British markets. Finally, tourist and power developments underline a new community of interests.

Stimuli produce changes. Ferries declined in favor of bridges. Portages gave way to railways. North-south river alignments altered to east-west ones along railroad and highway.

Compare Niagara-on-the-lake with Niagara Falls. Aligned first along the riverfront (portage era), Niagara-on-the-lake next expanded down the lakeshore road (steamship and stagecoach), then into the interior (era of railways and highway). These shifts left the northeast corner a zone of desolation, where river town was abandoned for lake town, and this in turn for the interior. Yet the three changes swung on the same cross-roads. The urban center remained relatively stable.

The situation is very different at Niagara Falls. There the portage center at Drummondville and the railway center at Clifton are being challenged by tourist and residential developments at a new focus. Shops, hotels, churches, schools are migrating to the new center, where the Rainbow Bridge axis cuts the main north-south axis of Victoria Street. They have left behind, at Erie St. and Ferry St., zones of tension, where land use is changing, rents are falling, ethnics congregating, unemployment is high. Meanwhile, industries growing on the outer margins of the old centers, compel residences to expand on their inner margin—toward the new center. Surburban growth escapes westward along the new Queen Elizabeth Way.

Thus a decline in the old centers of Niagara Falls, and their invasion by industrial areas, and the attraction of former elements about a new focus, have created zones of tension in north and south, and also zones of conflict about the new center, which are basic to social interaction.

These urban changes result from the impact of the American frontier. Their complexity shows that frontier patterns are in an uneasy balance in time between unequal struggles in space, and are peculiarly susceptible to human interpretations. There exist in nature only the patterns which we select.

LEONARD S. WILSON.

Map Classification, Processing and Use.

In the past there has never been a generally recognized system for cataloging, filing and indexing map collections. Some systematic method of processing must be developed that will enable large quantities of maps to be readily cataloged, indexed, and filed. The purpose of this paper is to present a possible solution to the problem.

In examining the problem the following 7 items may be considered as essential in the processing of maps: (1) Title, (2) Area, (3) Scale, (4) Publishing Authority, (5) Date and Edition, (6) Content, (7) Author. Any system must include these data to be satisfactory, and the information must be made available on standard library cards.

It is proposed to divide the world into continental and ocean units as the major area division; in turn followed by a sub-division of the continents and oceans into geographic regions as a second order of classification. Below this classification, countries in alphabetical order followed by quadrant divisions within nations and alphabetical order for minor divisions of countries is believed satisfactory.

Title, scale, publishing authority, date and edition, and author can be determined with comparative ease because the information is not of a kind that is open to wide interpretation.

The item most difficult of determination is subject. It is recommended that the classification of maps be confined to 25 major subject headings, and that all maps be processed according to that classification.

These classifications are as follows:

1. Surface
2. Geology
3. Soils
4. Climate
5. Drainage
6. Natural Vegetation
7. Native Animals
8. Political Boundaries
9. Population
10. Settlement
11. Historical
12. Railroads
13. Roads
14. Waterways
15. Air Communications
16. Power
17. Tele-Communications
18. Industrial Development
19. Minerals
20. Forest Exploitation
21. Agriculture
22. City Plans
23. Topographic
24. Cadastral
25. Base

In cataloging maps according to subject it is suggested that a departure be made from all present practices which necessitate the detailed examination

of each map for content without regard to the content placed on the legend by the publisher or author. Instead, it is suggested that the actual cataloging process be confined to a reproduction of the items listed on any legend, on the final catalog card.

In effect the proposed subjects are an attempt to include all items that may appear in any map legend, and by indicating the selections made for a particular map much of the personal judgment of the cataloger is removed and responsibility for map content is returned to the author and publishers where it rightly belongs. By so doing, a standard card embracing the 25 subjects and suitable sub-headings can be produced.

From the data on any card a code classification embracing all seven of the required items may be compiled, marked on the map, the card, and the file space, thus combining the needs of the cataloger, filer and user.

LEONARD S. WILSON.

Some Aspects of Geographic and Mapping Activities in War-time England.

The purpose of this paper is to present the problems and some of the methods of overcoming the problems of geographers and map agencies in England during the war.

The problems of personnel, equipment and supplies, are discussed with particular reference to professional geographers and government officials of Great Britain and their principal activities from 1939 to 1944.